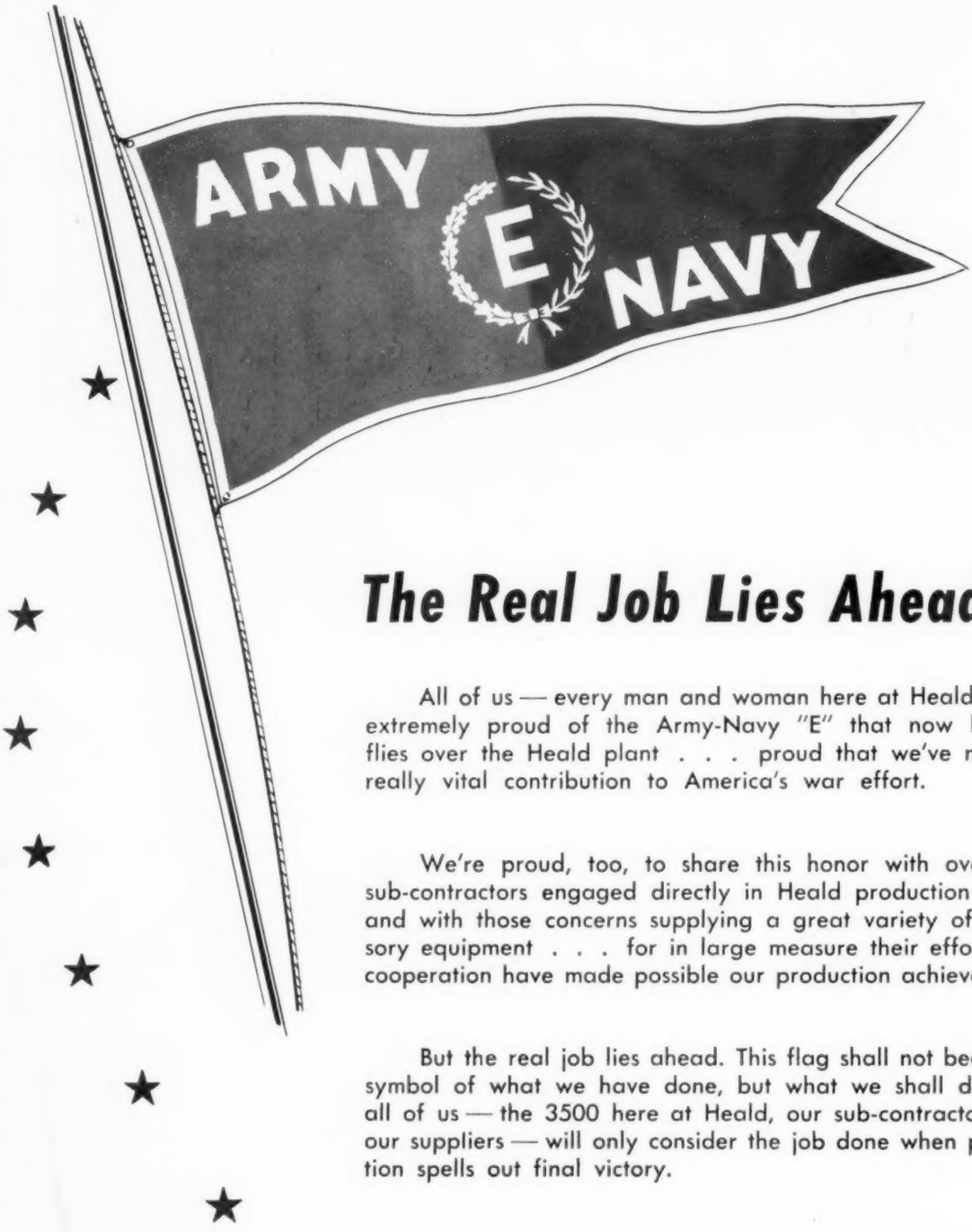
AMERICAN MACHINIST

SEPTEMBER 17, 1942

Standard Tools Speed Conversion — Page 1007

ARMAMENT: How to Machine Cast Armor Plate — Page 1023



The Real Job Lies Ahead...

All of us — every man and woman here at Heald — are extremely proud of the Army-Navy "E" that now bravely flies over the Heald plant . . . proud that we've made a really vital contribution to America's war effort.

We're proud, too, to share this honor with over fifty sub-contractors engaged directly in Heald production . . . and with those concerns supplying a great variety of accessory equipment . . . for in large measure their efforts and cooperation have made possible our production achievements.

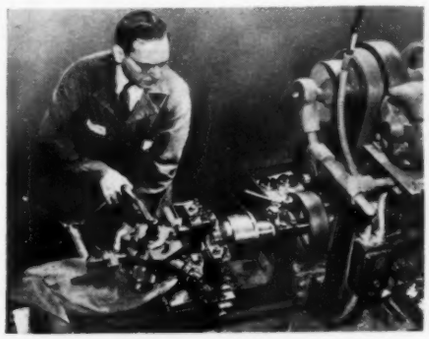
But the real job lies ahead. This flag shall not become a symbol of what we have done, but what we shall do. And all of us — the 3500 here at Heald, our sub-contractors and our suppliers — will only consider the job done when production spells out final victory.

The HEALD MACHINE COMPANY
WORCESTER, MASSACHUSETTS

Precision Boring and Precision Grinding Machines

AMERICAN MACHINIST

September 17, 1942



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COMING NEXT ISSUE . . .

Annual METAL SHOW Number

Helpful Information on Important Wartime Metal-Working Topics

★**THE SHOW IN PRINT**— 12 days before the opening of the Metal Show, this issue will preview the new equipment to be shown for the first time at the '42 Exposition. Complete index of exhibitors. A permanent, "between-two-covers" record of new war-production equipment for your reference—whether or not you attend.

★**NATIONAL EMERGENCY STEELS**— 15th in the series of widely used *American Machinist* "blue sections" on Working of Materials. Will discuss alternates for high-alloy steels, most of which have never before been used extensively. This compilation of facts will give practical data on heat-treating, welding, machining and otherwise fabricating these materials.

★**HEAT-TREATING ALUMINUM ALLOYS**—55th of the now famous *American Machinist* special Armament sections. This study will be a timely addition to the mass of practical armament production data accumulated through publication of these sections.

★**HARDNESS-TESTING**—An article particularly worthy of your close attention in view of the large amount of hardness-testing equipment to be displayed at the Show.

★**FLAME HARDENING WITH CITY GAS**—Final installment of this serial which Metal-Working production executives have been following closely. You won't want to miss this last chapter.

★**METAL COATING BY SPRAYING**— The materials situation has stimulated the search for alternate products and processes. This article will be a report on the latest successful methods being used in metal coating.

★**WELDING IN THE AIRCRAFT INDUSTRY**—In view of the tremendous strides being made in welding, this subject will receive extra attention this year at the Show. *American Machinist* will present new techniques in high-speed plane production.

Plus—many other regular and special editorial features . . . with page after page of helpful advertising that will give you specific data on the products you need and use.

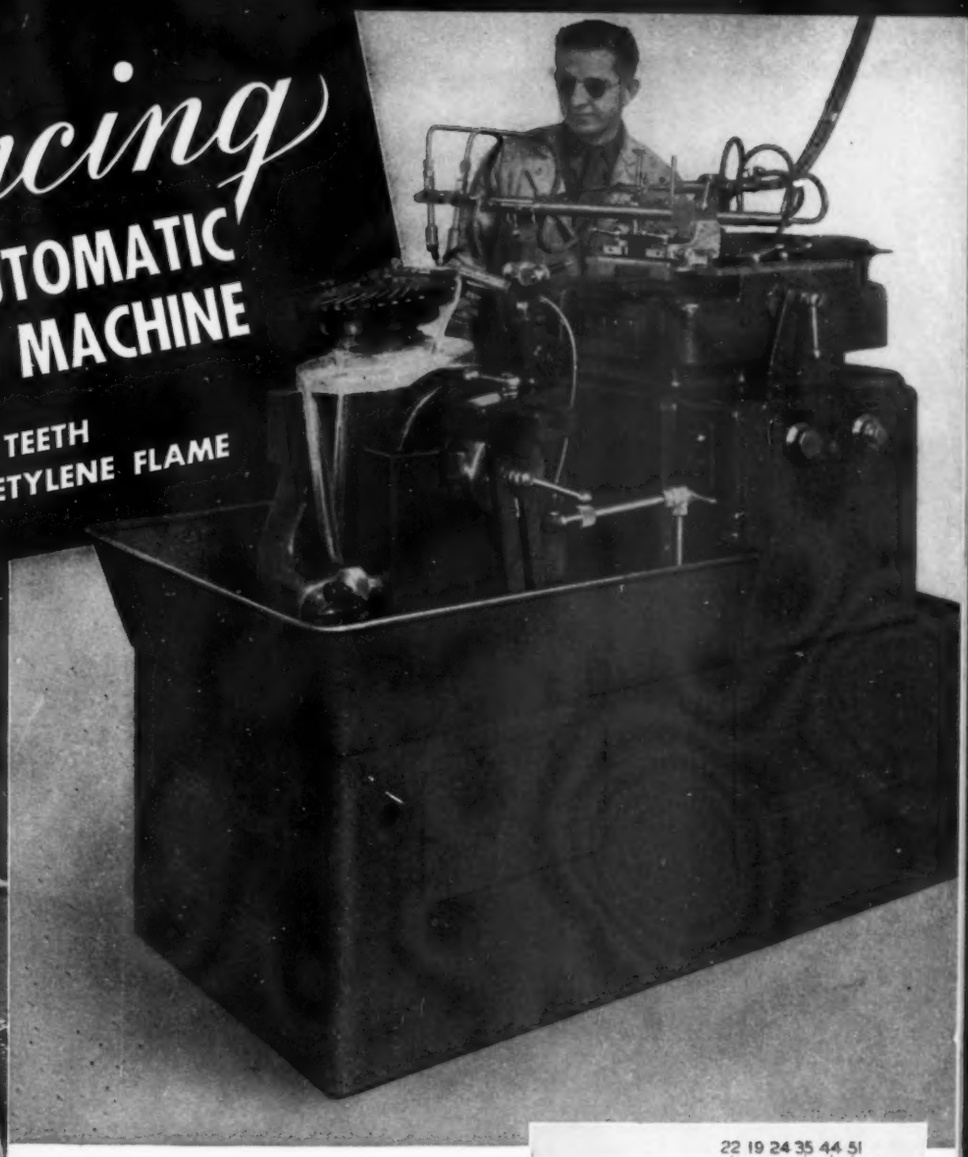
Whether or not you go to the show, you'll want to study this timely number

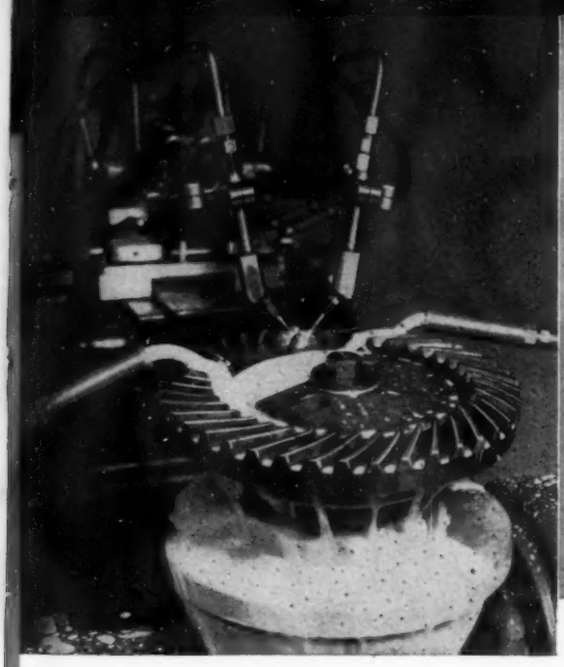
. . . Watch for Your Copy!

Announcing

THE NEW GLEASON AUTOMATIC SURFACE HARDENING MACHINE

FOR HARDENING GEAR TEETH WITH OXY-ACETYLENE FLAME





With this new machine all the advantages of flame hardening are profitably extended to medium and small-size bevel, spur and internal gears, sprockets and the like.

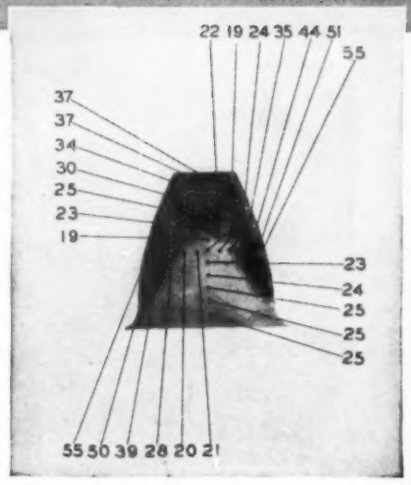
Both sides of a tooth are hardened simultaneously without distortion. Each tooth is hardened in exactly the same length of time and to the same depth as every other tooth. The machine is fully automatic in operation including indexing from tooth to tooth.

Straight-line cams guide the burners along the tooth, and on spiral bevel and helical gears the work rolls in timed relation to the torch advance so that the burners accurately follow the lengthwise tooth curve. Hydraulic control varies the burner speed to allow for heat accumulation ahead of the burners and on bevel gears to compensate for the taper of the teeth; the control also increases the burner speed at the ends of the teeth to prevent overheating.

Write for complete information.

CAPACITY

Pitch Dia., maximum	
Bevel Gears	33"
Spur and Helical Gears	26"
Internal Gears	21½"
Pitch, maximum	1½ DP
Face Width, maximum	4"
Floor Space	36" x 58"



Etched cross-section of hardened gear tooth. Rockwell "C" readings show gradual change from hard, durable tooth surface to tough, shock-resistant core.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

For Continued

CINCINNATI

Since 1884 a group of men devoted to doing a better job and giving an increased measure of service.

THE CINCINNATI M

MILLING MACHINES

Achievement

Last March we received the Navy "E" for production achievement. But in August came the real reward — a white star to signify that we have maintained the pace in the building of machine tools.

In his letter of August 29th, announcing the renewal of our award and substitution of the Army-Navy pennant for our original Navy "E", Admiral H. A. Wiley, USN (Ret.) said: "On behalf of the Under Secretary of the Navy, I congratulate every man and woman of The Cincinnati Milling Machine Co. on their patriotic achievement. This production award is not lightly bestowed in the first instance; the requirements for renewal are equally exacting. By being selected for the honor a second time you have demonstrated that yours is no halfhearted, flash-in-the-pan effort, but rather a solid determination to supply the Navy with the materials it must have to carry the engagement to the enemy. That's the spirit which has made the nation what it is today. It is the spirit that will win this war."

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

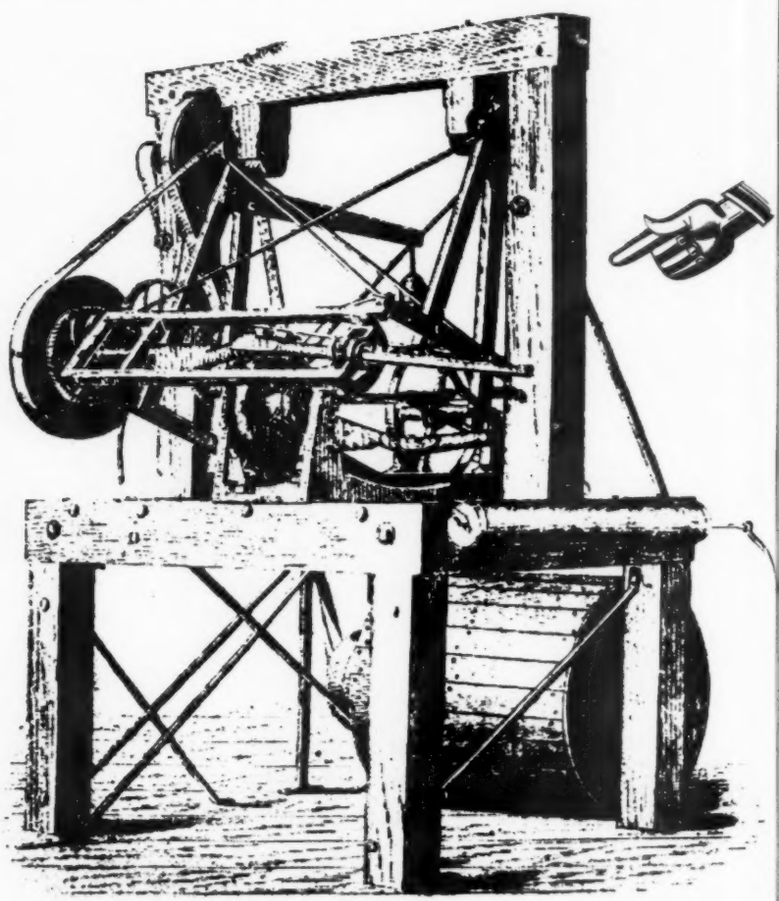
BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

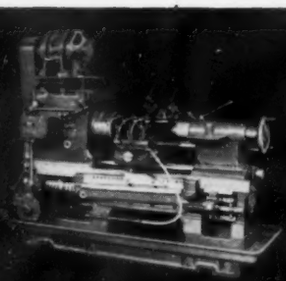
A Curious

THIS bit of early-American humor, which appeared in a New England newspaper more than a century ago, may well have been inspired by the "curious machine" shown here. It marks the beginning of a public awareness of the mechanical wonders ahead . . . Back in the days when "Industry" was spelled with an f, it was the birth notice of the Machine Age in America.

Picture the times when that notice appeared: Witchcraft was still a subject for serious dispute, and sane men believed that insanity was caused by Devils. Cocked hats and big-buckled shoes were still to be seen, and sober men declared the steam engine a passing idea, over their tankards of flip in the taverns. . . .The hammer and anvil were the symbol of the times, and every part of every musket or cannon or clock was made individually, by hand.

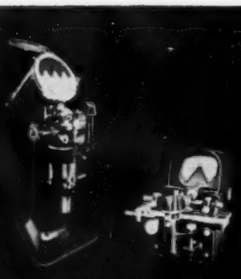
That was the setting. And in the midst of it, some of the greatest inventive geniuses the world has ever known were quietly changing the shape of things and of thought with the "curious machines" they were inventing. Such curious machines as the one shown here. Machine tools, with which each part could be made in quantity, and precisely alike. . . . Tools that were to make machines that would churn, scrape potatoes, rock the cradles of industry, and even darn stockings!





FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

s Machine

has been lately advertised, that will churn, Scrape Potatoes, rock the cradle and Darn Stockings!

BUT they were doing more of importance than inventing curious machines. Those men of mechanical genius were founding a handful of machine tool companies that have literally made possible all the rest of industry.

One of those companies — Jones & Lamson — is here today, a direct descendant of the first great machine tool builders in America. With a heritage of skills, knowledge and equipment that has constantly grown, from the very birth of our industrial age, Jones & Lamson engineers and service men are particularly qualified to serve any phase of industry today and during the difficult period of post-war readjustment ahead.

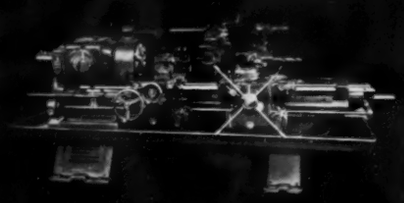
Jones & Lamson is at *your* service now!

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, *Vermont,* U. S. A.

PROFIT PRODUCING
MACHINE TOOLS

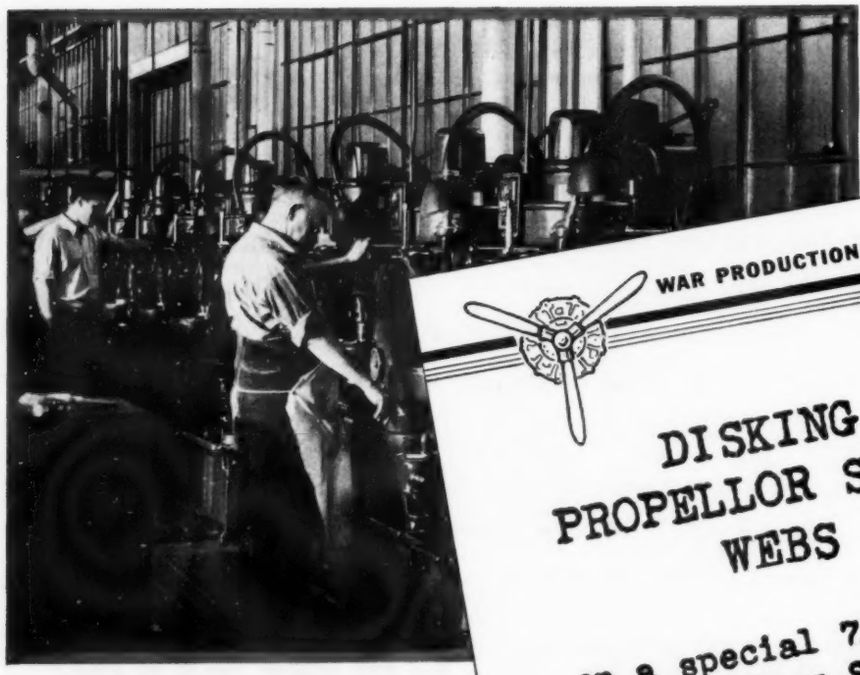


SADDLE TYPE
UNIVERSAL TURRET LATHE

RAM TYPE
UNIVERSAL TURRET LATHE

A MODIFIED Gear S

OFTEN SU



A battery of Fellows Gear Shapers in a mid-western airplane motor plant.

WAR PRODUCTION BULLETIN

DISKING PROPELLOR SHAFT WEBS

on a special 7A-type Fellows Gear Shaper radically cut production time, and greatly improved the accuracy and finish of product.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

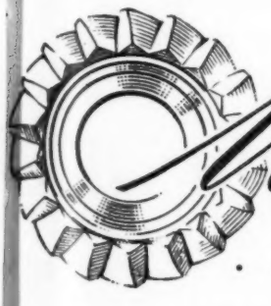
ar Shaper

EN SUPERIOR TO SPECIAL

SINGLE-PURPOSE MACHINES

The extremely high precision of the Fellows Method and its wide range of application has made possible its broad war-time utilization, far beyond that of the general run of gear cutting. The precision-machining of the irregular profiles referred to on the opposite page, is but one of many cases where milling has been replaced by generating, with exceptional results, both as regards reduction in number of operations, character and accuracy of finish.

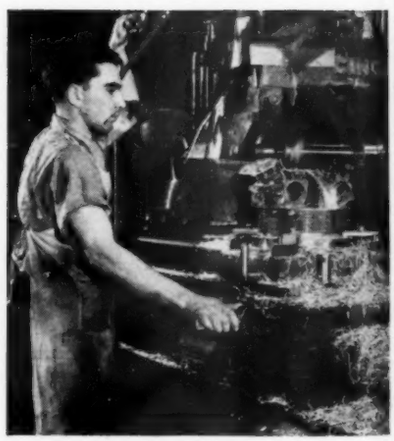
When confronted with a production job of duplicating parts of plain or irregular outline, we recommend you turn to a copy of "The Fellows Method." Its 64 pages are full of illuminating suggestions. If you wish a copy, write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.



Method

. . . . FROM BLANK TO FINISHED GEAR

Since 1884 a group of men devoted to doing a better job and giving an increased measure of service.



CINCINNATI

THE CINCINNATI

MILLING MACHINE

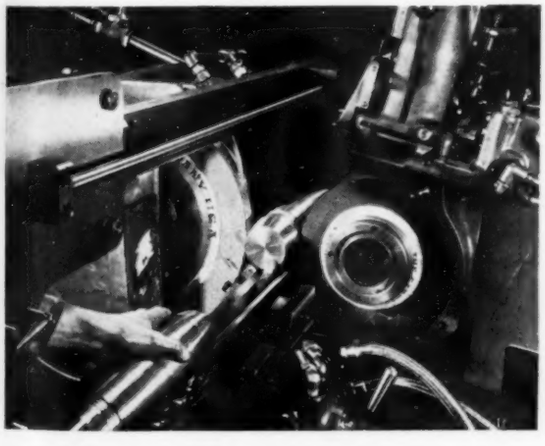
58 YEARS OF... PRODUCTION VICTORIES

Whether the nation has been at war or peace, Cincinnati Milling has been winning engineering victories day after day since 1884.

People have been bringing us their production engineering problems and asking us to help them make parts better, quicker, more efficiently, using less plant space. Our employees have been licking those problems one by one, gaining richly the while in "know-how" and experience.

So valuable to the industrial world is our store of past experience and present ability that we have naturally become the largest builders of machine tools in the world . . . headquarters for milling, grinding, broaching and lapping.

But in war or peace our engineers, research technicians, skilled old hands and alert new hands are available to those who would make America stronger and greater through production of more and better goods. With a vast storehouse of information and acres of equipment, they are prepared to help solve your production engineering problems.

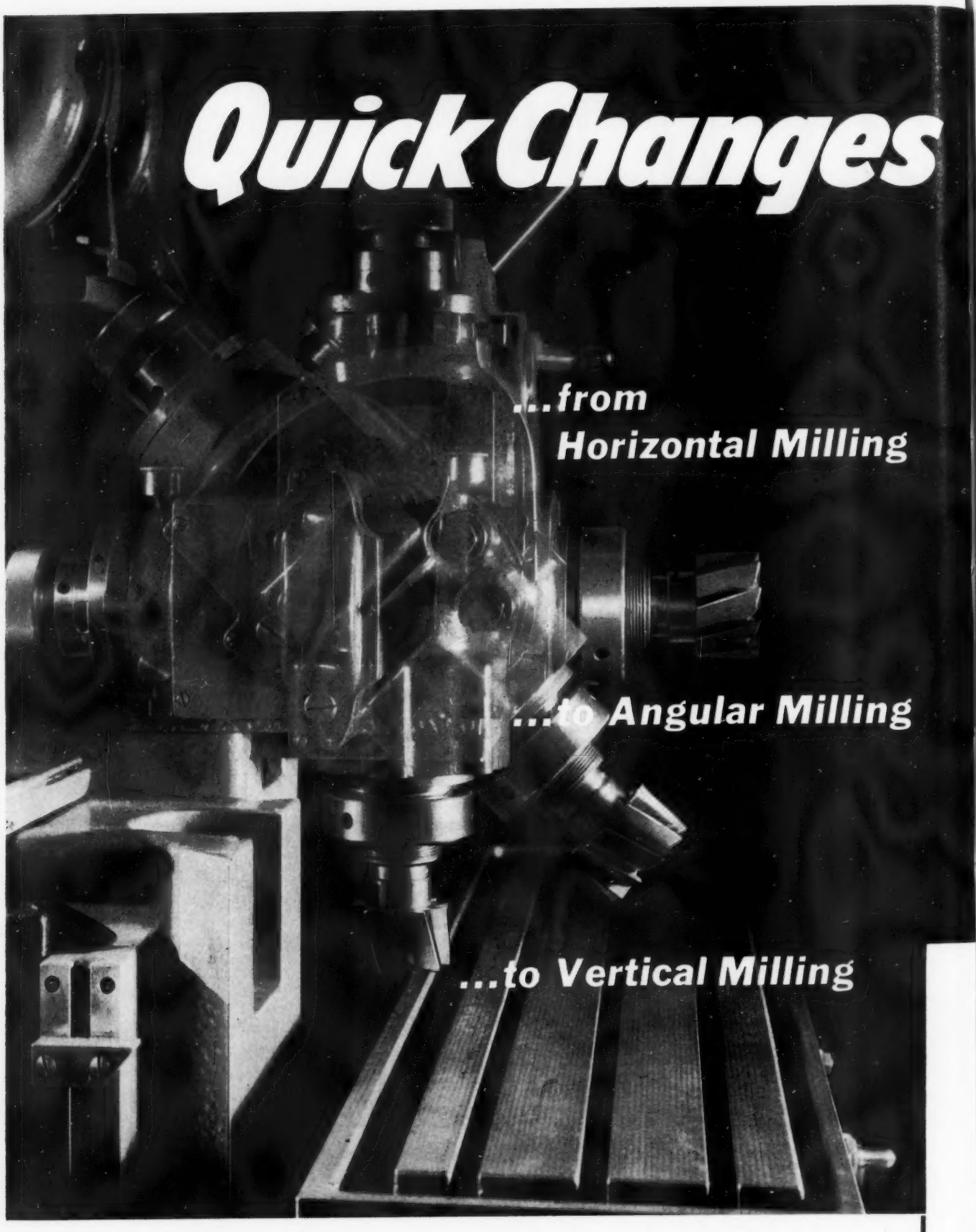


O. E. M. photo by Palmer taken in our plant.

O. E. M. photo by Palmer taken in our plant.

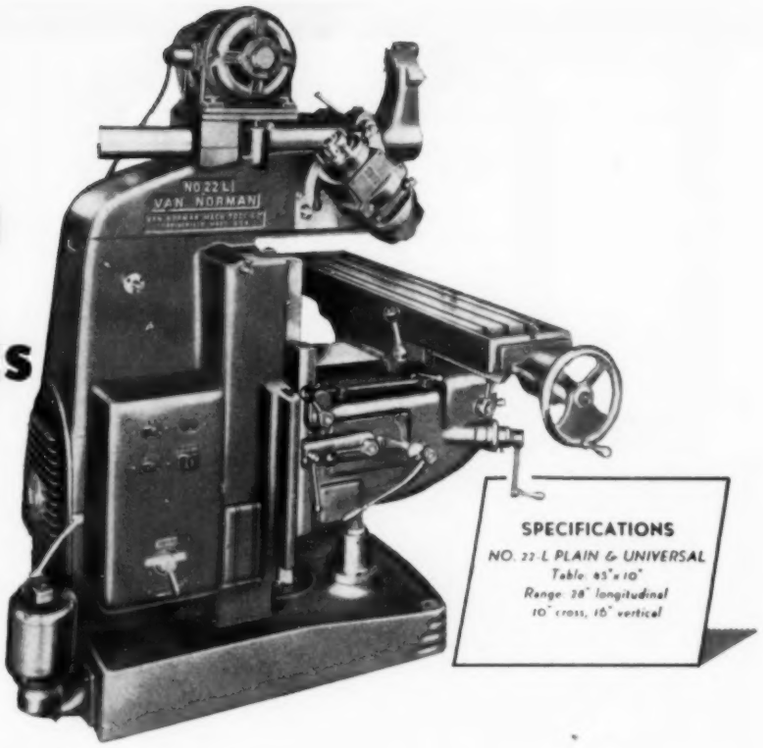
MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

• BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES



VAN NORMAN MACHINE TOOL COMPANY

ON VAN NORMAN RAM-TYPE MILLING MACHINES



When the operator has completed a horizontal cut on a Van Norman Ram-Type Miller, and wishes to proceed to an angular or vertical cut . . . *he does not need to touch the set-up on the table.* All he has to do is unclamp the swiveling cutterhead, swing it to the required position, reclamp . . . *and start the next cut.* Only a matter of moments, compared with the time needed to reset the work. And one of the greatest sources of errors is completely avoided. This exceptional ease and convenience of operation provide gains in time, accuracy and output. So today, throughout America's war industries, Van Norman Ram-Type Millers are delivering the goods in great plenty . . . and in plenty of time.

Van Norman

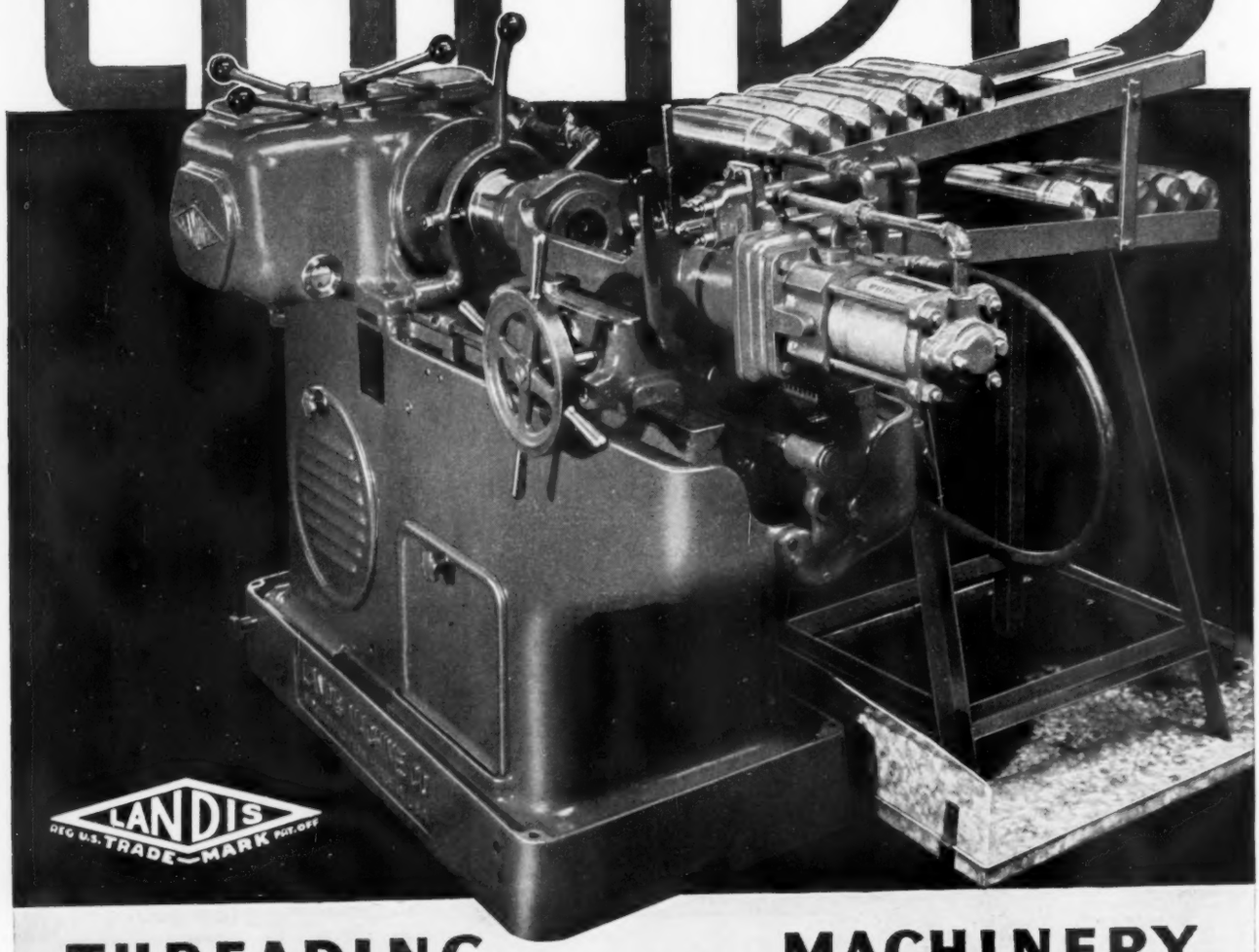
MILLING MACHINES

ARMY E NAVY

In June, 1942, Van Norman was awarded the Army and Navy E in recognition of its war production record

SPRINGFIELD, MASS.

LANDIS



THREADING MACHINERY

THREAD CUTTING DIE HEADS

COLLAPSIBLE TAPS

Greater Accuracy
Higher Production
at Lower Cost....
Write for Catalog

LANDIS MACHINE COMPANY

WAYNESBORO, PENNSYLVANIA, U.S.A.

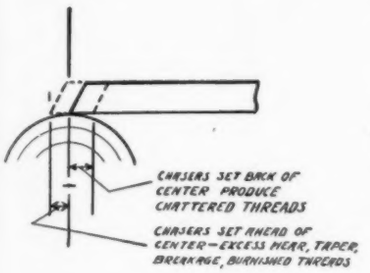
LANDIS REG. U.S. TRADE-MARK PAT. OFF.

THREAD TIPS

A Good Mechanic Knows and Cares For His Machine

In the Interest of Efficiency, Better Workmanship and Higher Production

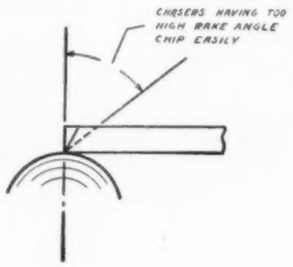
LIFE OF LANDIS TANGENTIAL CHASER IS MATERIALLY INCREASED BY ELIMINATING REASONS FOR MECHANICAL FAILURE


CHASERS SET BACK OF CENTER PRODUCE CHATTERED THREADS
CHASERS SET AHEAD OF CENTER—EXCESS WEAR, TAPER, BREAKAGE, BURNISHED THREADS

SETTING CHASERS TOO FAR OVER CENTER OF ROTATION CAUSES EXCESS WEAR

The chaser setting gauges for Landis Die Heads are designed to set the chasers theoretically upon cutting center. However, due to the hardness of material and the variation in the machineability of materials, it is frequently necessary for the user to alter the chaser setting position slightly to obtain satisfactory results. The chasers should be set uniformly with a gauge and then checked for "radial" with a scale. If the chasers are set too far over center, they will tend to burnish the thread and wear excessively back of the cutting edge, thus making it necessary to grind away an unusual amount of the tool to bring it to the cutting edge. If the chasers are too far back of center they will tend to dig into the work, thus causing the chasers to chip frequently and require frequent regrindings.

CHASERS HAVING TOO HIGH RAKE ANGLE CHIP EASILY

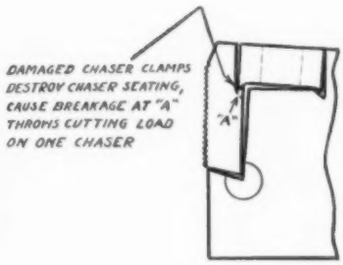


The correct rake angle for any given material is best determined by experimentation. The lowest possible rake angle consistent with good thread quality is recommended to eliminate frequent regrindings. Chasers having a rake angle which is too high chip easily on the cutting edge, in such a manner as to give the chaser the appearance of being too soft. This condition frequently results in users complaining that the chasers are not sufficiently hard.

Mechanical Causes of Chaser Chipping

Thread-cutting and other tools made from high speed steel are frequently misused with the result that mechanical failure occurs. The users of Landis Thread Cutting die heads and thread cutting machines will obtain the maximum operating efficiency from this equipment, the longest possible life, the lowest cost and best quality of thread form from their chasers by eliminating the following reasons for mechanical failure.

DAMAGED CHASER CLAMP AND HOLDER THROW ALL DUTY ON ONE CHASER

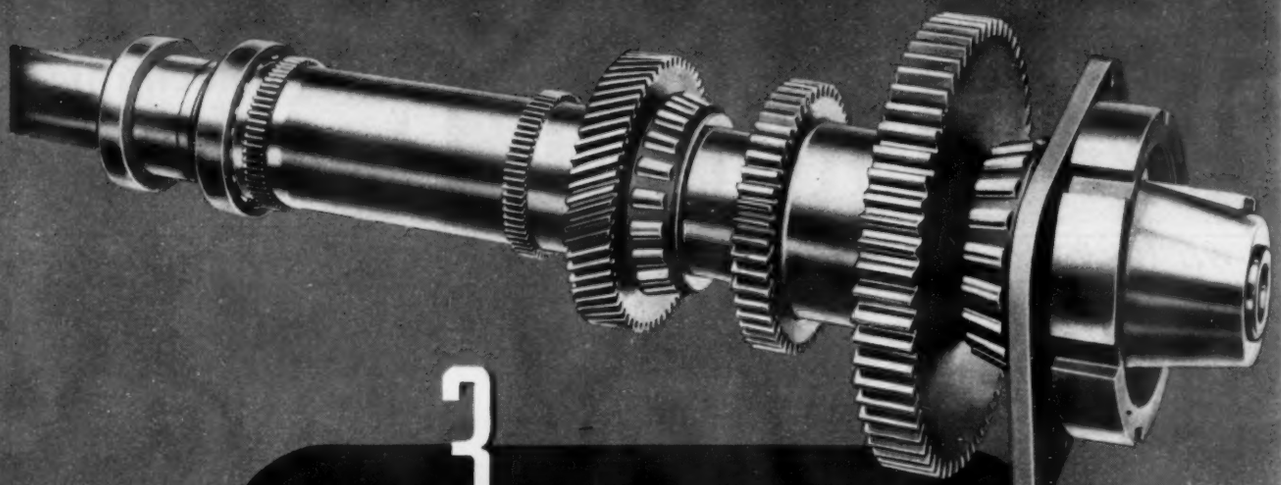


In the rush of production, operators of die heads are sometimes inclined, when interchanging chasers, to be careless in failing to remove the accumulation of fine cuttings and dirt from beneath the chaser clamps. Furthermore, chips will sometimes lodge in the dovetail of the chaser. The action of clamping down on this accumulation of chips will bruise or raise high spots along the clamping surface of the chaser clamp with the result that the chaser will be prevented from seating properly in the chaser holders. If a chaser fails to seat properly, it will be thrown out of its proper alignment, resulting in poor qualities of thread finish and unusually rapid wear of the chaser.

To prevent excess wear, inspect the chaser clamps and chaser holders periodically, removing all bruises or high spots with a hone. The chaser clamps should never be ground.

Be Threadwise—Employ LANDIS Long Life Tangential Chasers

LANDIS MACHINE COMPANY
Waynesboro, Penna., U. S. A.



THIS 3 BEARING SPINDLE *is now standard on* "AMERICAN" PACEMAKER

. . . for greater smoothness, quietness and rigidity at all speeds . . .

Unquestionably the three-bearing spindle is the stiffest spindle construction offered in lathe design. Complete elimination of deflection under heavy service is provided by an intermediate or center bearing at the very point where it is most needed.

This rigid spindle mounting assures long life for driving gears as well as smooth, quiet operation at all speeds and under heaviest service.

Spindle expansion resulting from temperature rise is taken care of in this three bearing "AMERICAN" construction by a rear bearing of the floating type.

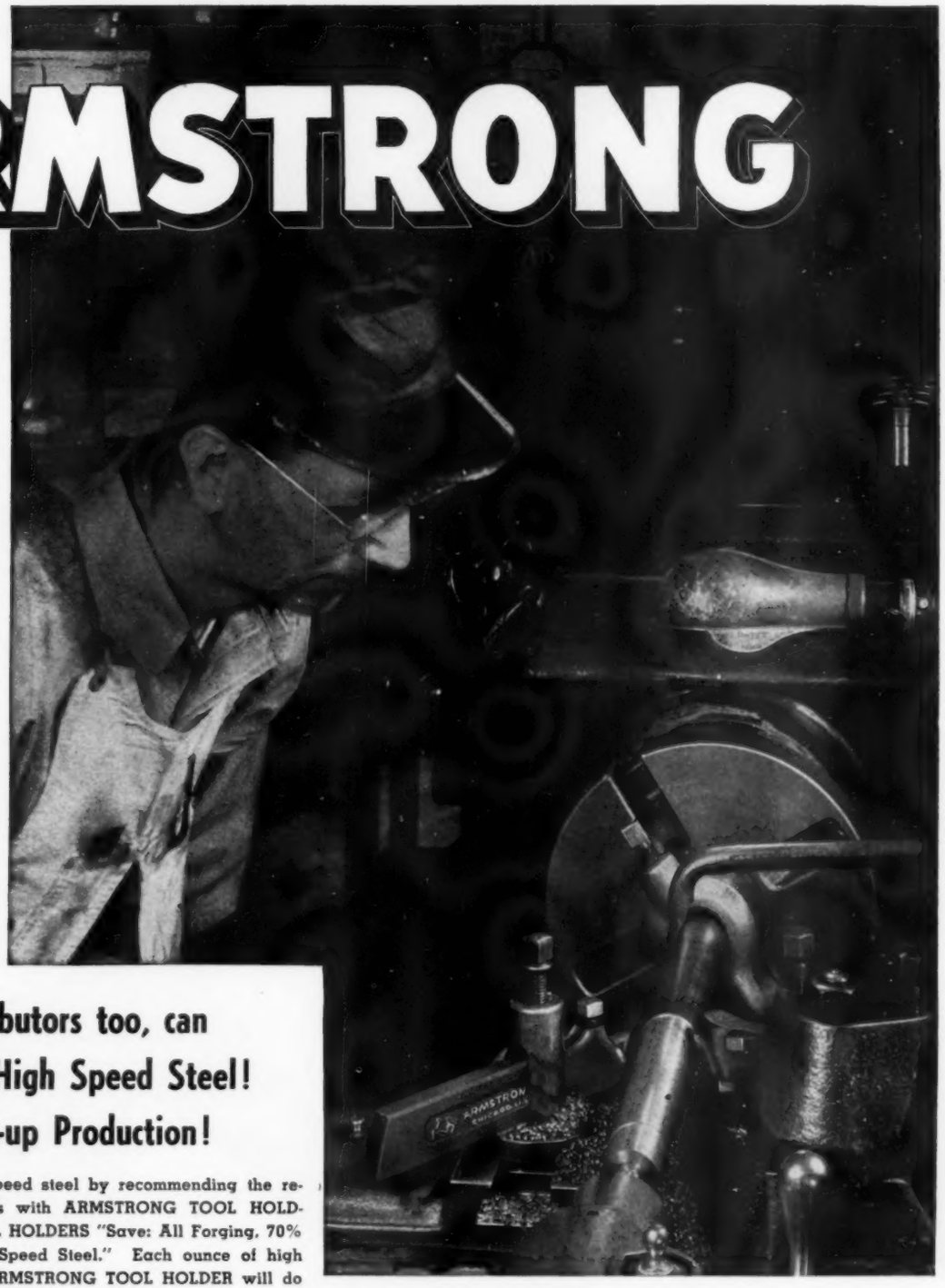
The many new and outstanding characteristics of the "AMERICAN" Pacemaker Lathe are fully described and illustrated in Bulletin 15, available on request.

LATHES
RADIAL
SHAPER

THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U.S.A.

ARMSTRONG



Industrial Distributors too, can Help Save High Speed Steel! Help Speed-up Production!

Help save critical high speed steel by recommending the replacement of forged tools with ARMSTRONG TOOL HOLDERS. ARMSTRONG TOOL HOLDERS "Save: All Forging, 70% Grinding and 90% High Speed Steel." Each ounce of high speed steel used in an ARMSTRONG TOOL HOLDER will do the work requiring 10 ounces in a bar tool.

By recommending the switch to ARMSTRONG TOOL HOLDERS you not only stretch high speed steel reserves ten times as far, you also eliminate "tool dressing" time, reduce tooling-up to the selection of a cutter and tightening of a set screw and increase production capacity on each operation. The latter because ARMSTRONG TOOL HOLDERS cut efficiently at speeds and feeds far above those ordinarily used, stand up to any speed or feed the machine tool can attain.

Save High Speed Steel and Step up Production by recommending the use of ARMSTRONG TOOL HOLDERS for all operations on lathes, planers, slotters and shapers.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

Buy ARMSTRONG TOOLS from your Supply House

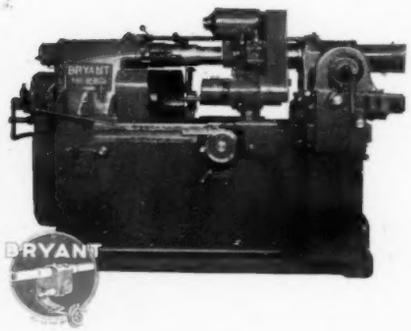
ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

Put in a phone call for Bryant

"Operator, give me long distance — Springfield, Vermont, FIVE - SIX - O: Bryant Chucking Grinder Company — station to station."

When bothersome questions crop up on internal grinding jobs, time and money can often be saved if you put in a phone call for Bryant.

Whether the answer can be given at once in so many words, or whether Bryant can help you more by dispatching bulletins, memos, blueprints or even a service crew to the scene of action, you can count on a prompt response when you put in a phone call for Bryant.



Bryant's productive capacity, already tripled, is constantly increasing. No other organization in America of comparable size and experience is devoted *exclusively* to designing and building machinery for internal grinding work.

Not only should Bryant engineers be able to help you speed war production, but they welcome opportunities to begin work, *at the earliest possible stage* on new products for post-war markets.

If you believe in planning ahead, put in a phone call for Bryant.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

ON THE SPOT WITH A PRODUCTION PROBLEM?

. . . . SEND A WIRE TO THE EMERGENCY PRODUCTION SERVICE DEPT. OF KEARNEY & TRECKER

Getting the tools to do the work is often more of a problem than the production job itself. Sometimes it just gets down to having the *know how* to use present equipment or merely adding a standard attachment which adapts or converts an existing milling machine in your plant to a particular operation.

When you are on the spot with a difficult milling job the Emergency Production Service Department of Kearney & Trecker Corporation is at your service. They have the *know how* to be able to suggest getting the most in performance from your present Milwaukee milling machines . . . to extend their range of application and usefulness with standard attachments and accessories.

Kearney & Trecker believes that their Emergency Production Service can help you just as it has helped others faced with production problems. To avail yourself of it all you need to do is pick up your telephone and send a wire, stating your problem, to this Department. Immediately upon receiving your wire, arrangements will be made to have a trained field representative contact you at once. Depending upon the nature of your problem he will provide you with complete technical information or call directly at your plant.

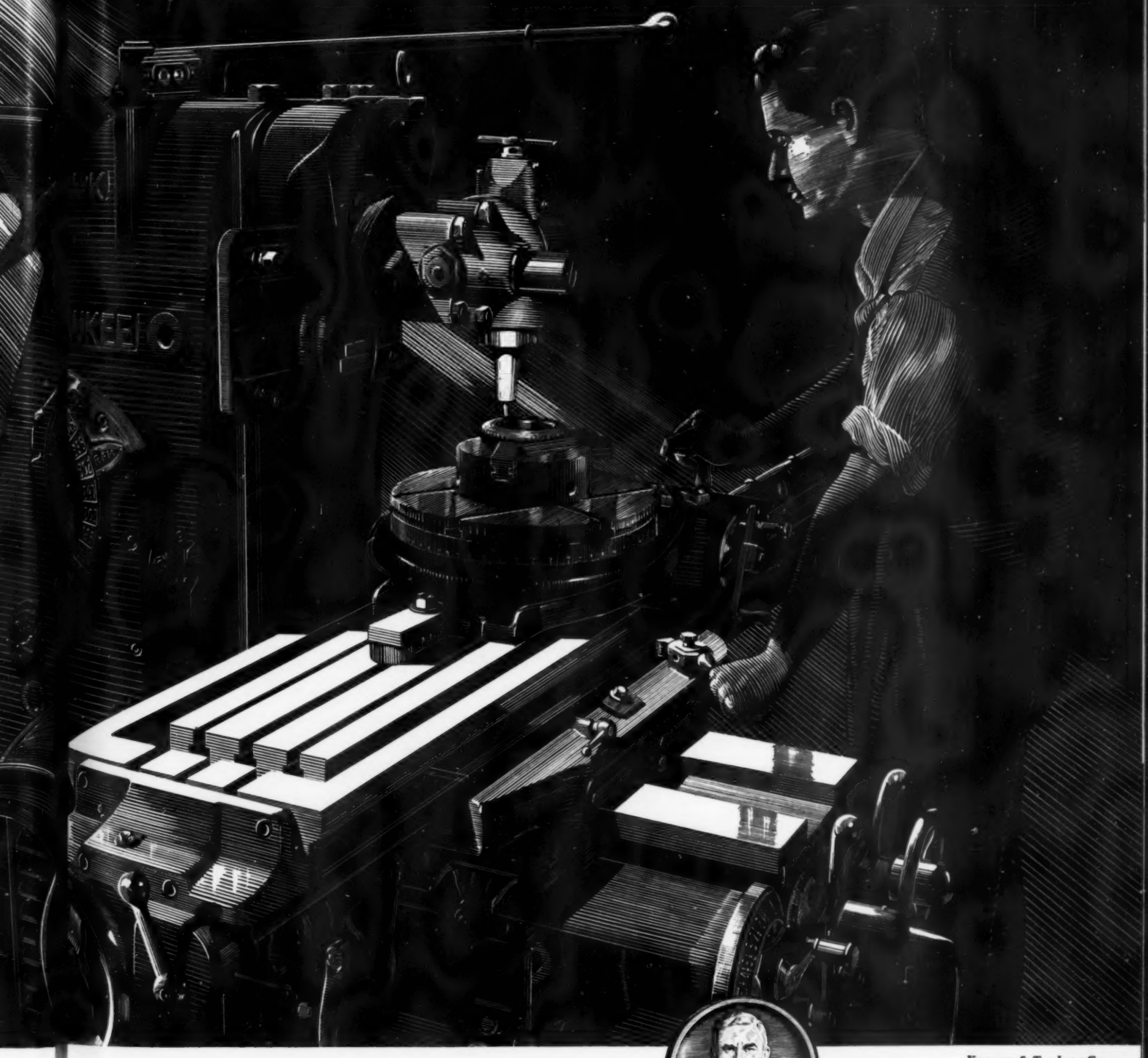
The Emergency Production Service Department of Kearney & Trecker is maintained for your benefit—to aid you in your war effort. We urge you to make use of it.

Here is an exceedingly versatile attachment that should be put to work in your plant — to relieve machine shortage — to avoid the difficulties of getting new machines — to add to the range and usefulness of your present Milwaukee Milling Machines.

It's the Standard High-Speed Adjustable Universal Milling Attachment, shown above in use in conjunction with a low lead attachment and rotary table for end milling a scroll. This is but one of many applications of this versatile tool, such as milling on dies, metal patterns, templets, T-slots, dovetails and other milling operations. When used with a rotary table, circular milling operations can be performed. When used with a dividing head with lead attachment spiral milling operations can be accurately and rapidly performed.

Milwaukee MACHINE

THIS ATTACHMENT *PINCH-HITS* ON MANY PRODUCTION JOBS...



Look into this and many other Milwaukee milling attachments—to help solve particular milling problems—to break production bottlenecks—to extend the use and range of application of your present Milwaukee Milling Machines. Write for the complete file of literature on Milwaukee milling attachments.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN

Kearney & Trecker offers a complete file of bulletins and technical literature including the "Right and Wrong of Milling Practice"—an illustrated handbook showing right and wrong methods of milling — full of practical advice that will aid your men to become better milling machine operators. Write Department C for your copy.

KEARNEY & TRECKER
CORPORATION

T O O L S

....THEN

At the detector, they've picked up a submarine. Quick and accurate maneuvering brings the destroyer closer and closer. Depth bombs find their target.

Power is poured to the propeller from high-speed engines through reduction gears and pinions. These pinions, though relatively small parts of the ship's driving mechanism, transmit the power that enables the destroyer to attack.

Much of the finishing work on pinions is done on Monarch lathes with mechanical profile attachment. Many times faster than by manual operation, and with greater precision, these lathes reproduce exactly the specified patterns that give the pinions their interchangeability and effectiveness.

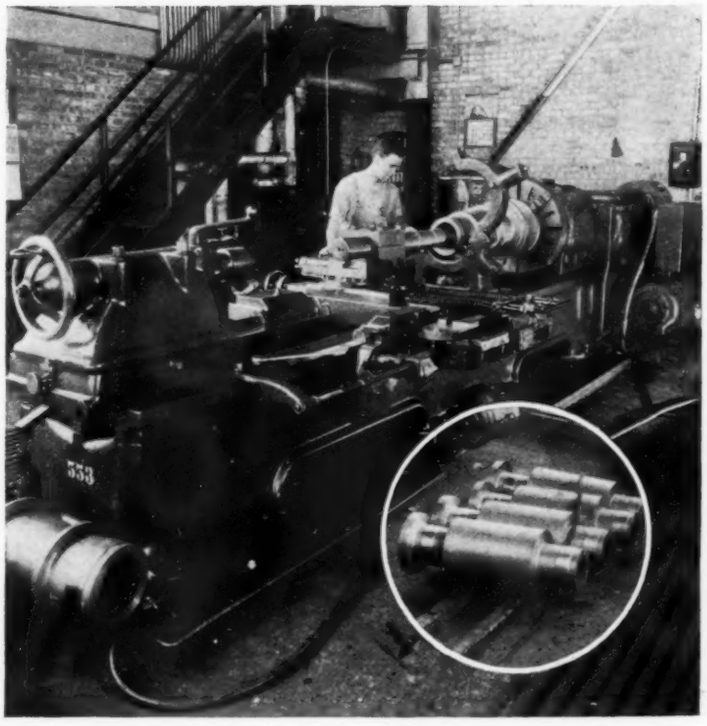
Thousands of Monarch lathes are helping to build our two-ocean Navy. They're busy, too, on planes and tanks and guns and munitions for our world-wide fronts. Though we're delivering twice as many Monarchs in 1942 as in 1941, accuracy is still "the order of the day."

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

COVER THE TURNING FIELD

N THINGS BEGIN TO HAPPEN!

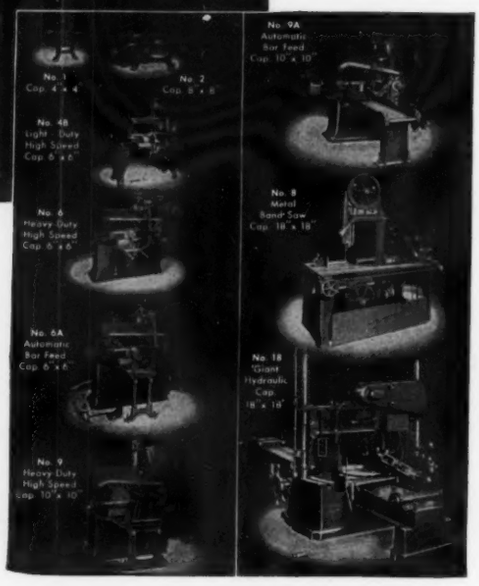


One of the many plants using Monarch lathes in ship and armament production. For short or long runs, Monarch electrically or mechanically controlled lathes save essential time and assure the accurate tolerances required in war production.

Faster for Fighters WITH MONARCH LATHES

MARVEL SAWS

MARVEL SAWS handle orders as they come, at Jones & Laughlin Warehouse



• **No. 9A MARVEL Production Saw automatically cutting-off quantity run — 3 bars at a time. This heavy-duty all-ball-bearing machine cannot be surpassed in speed, simplicity, ruggedness and dependability.**

• **A universal No. 8 MARVEL Metal-cutting Band Saw, that cuts-off, miters, notches or cuts at any angle from 45° right to 45° left. Blade feeds into the work.**

Hot rolled and cold finished steel squares, rounds, hexagons and flats,—single pieces or hundreds of pieces, lengths or slices, small bars or large (to 18" x 18") are cut-off quickly, accurately and efficiently at the Jones & Laughlin Steel Corp. Detroit Warehouse with MARVEL SAWS. "We are very pleased with all machines" sums up their MARVEL experience.

ARMSTRONG-BLUM MFG. CO.

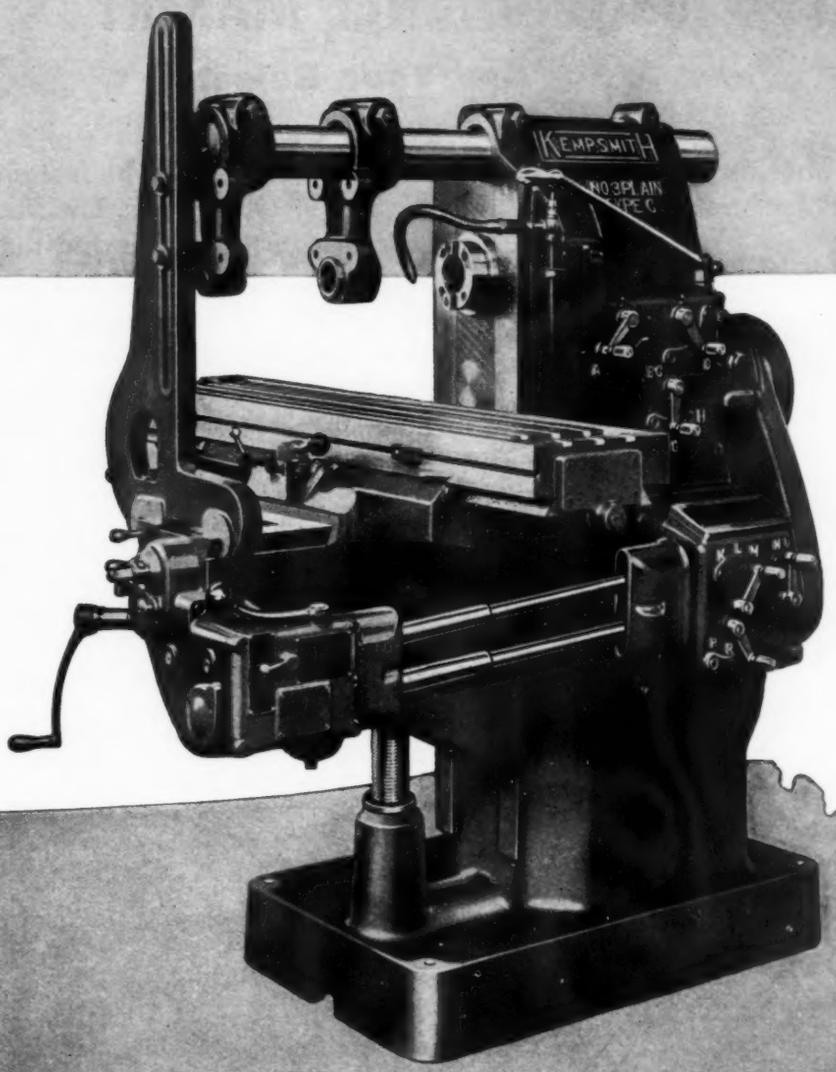
"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York

KEMPSMITH *and* INDUSTRY

MUTUALLY MILLING *for* VICTORY



For Toolroom and general production work the new **KEMPSMITH TYPE "G" All-Geared MILLER** (plain or universal) has centralized control, 18 speeds and feeds (ball bearing speed, feed and spindle assemblies), Knee Gib, Unit Construction, Motor-in-Base . . . and other features that make it precise and reliable, economical in first cost, fast and efficient for **PRODUCTION NOW!**

PRECISION

MILLING MACHINERY

Experience SINCE 1862

KEMPSMITH MACHINE CO.

MILWAUKEE • WISCONSIN

MID-WEST ABRASIVES MEAN *Fewer Rejects* TO THIS ORDNANCE MAKER!

How Costly Are Your Rejects?

Rejects, the bane of all production men, presented a serious problem at the X Corporation — until MID-WEST abrasives helped to eliminate them.

The X Corporation, one of the most vital gun producing plants in the country, had trouble finding the proper honing stones for the roughing and finishing of 20 millimeter guns. The job called for removing about .006 inches of stock — and doing it with machines equipped with three-stone heads.

The stones being used were generating too much heat. The honing operation was too slow. The honing stone "wear" was too fast. The working surface being created was too rough. And most important of all, rejects were entirely too numerous.

A MID-WEST engineer, invited into survey the situation, solved the company's problem. Here's how he did it:

Under pressure and coolant conditions identical with those the company had been employing he installed MID-WEST 320 103X hones. The new hones produced a fine finish and the honing time was cut in half — but production was limited to two gun barrels per set of stones. Not satisfied with that result the MID-WEST engineer tried again. He installed MID-WEST 320 120X hones. He also reduced the hydraulic pressure from 175 pounds to 125 pounds and suggested a thinner coolant. Those two changes, along with the 320 120X hones, did the trick. They resulted in:

- ✓ **FASTER CUTTING ACTION**
- ✓ **A MUCH FINER FINISH**
- ✓ **A LONGER HONE LIFE**
- ✓ **ALMOST COMPLETE ELIMINATION OF HEAT**

What MID-WEST MICRO BOND honing stones did for that manufacturer they also can do for YOU! Why not let our engineers—located in most large cities —prove it to you?

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

Mid-West

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

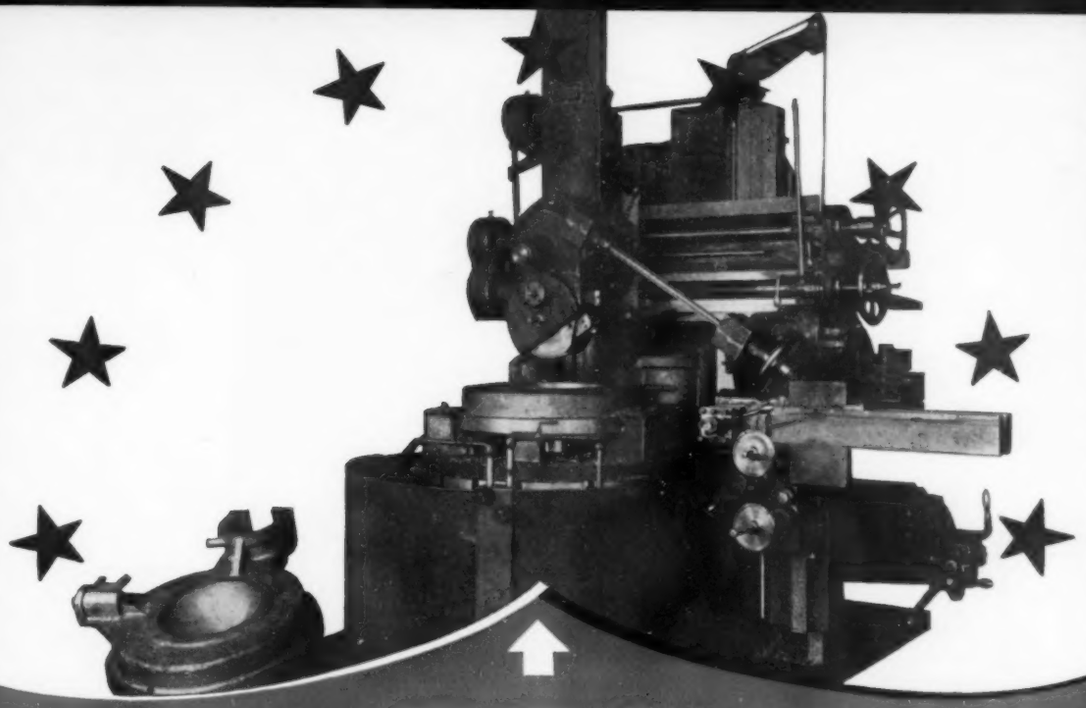
Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

Name _____

Company _____

Address _____

_____



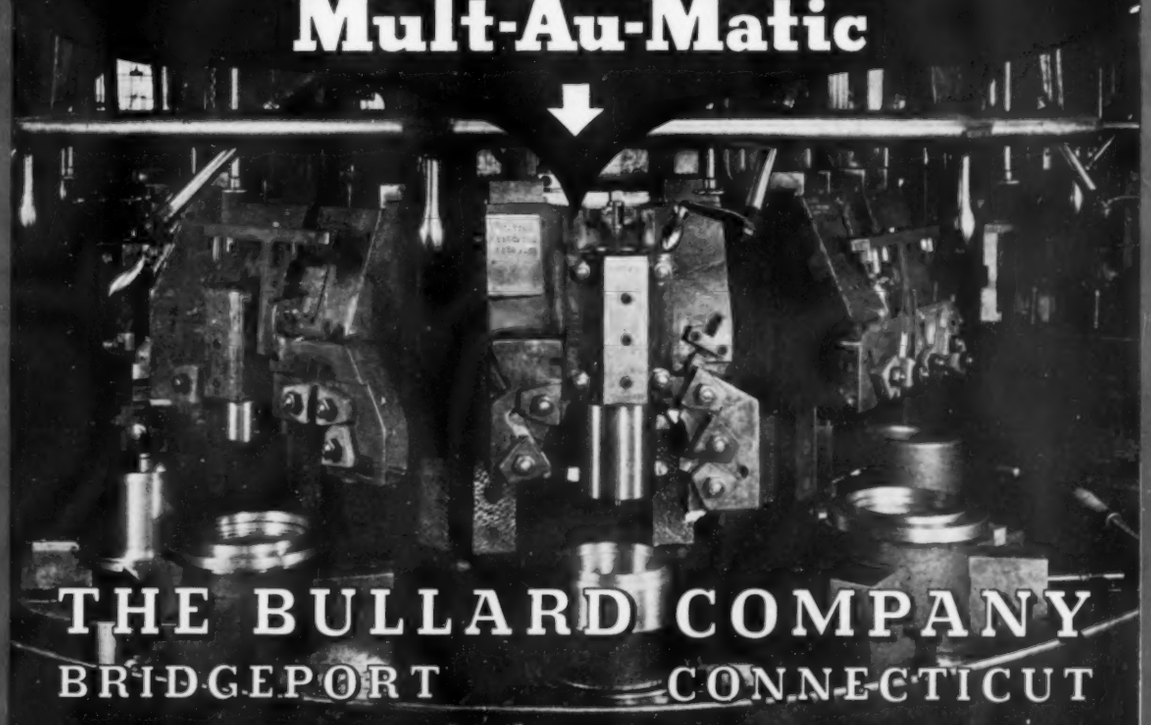
V.T.L.

Much higher production on War parts was made possible by a special attachment that took full advantage of the productive possibilities of the machine. We gladly design attachments.

You GET MORE *from a Bullard because you can* DO MORE *with it!*

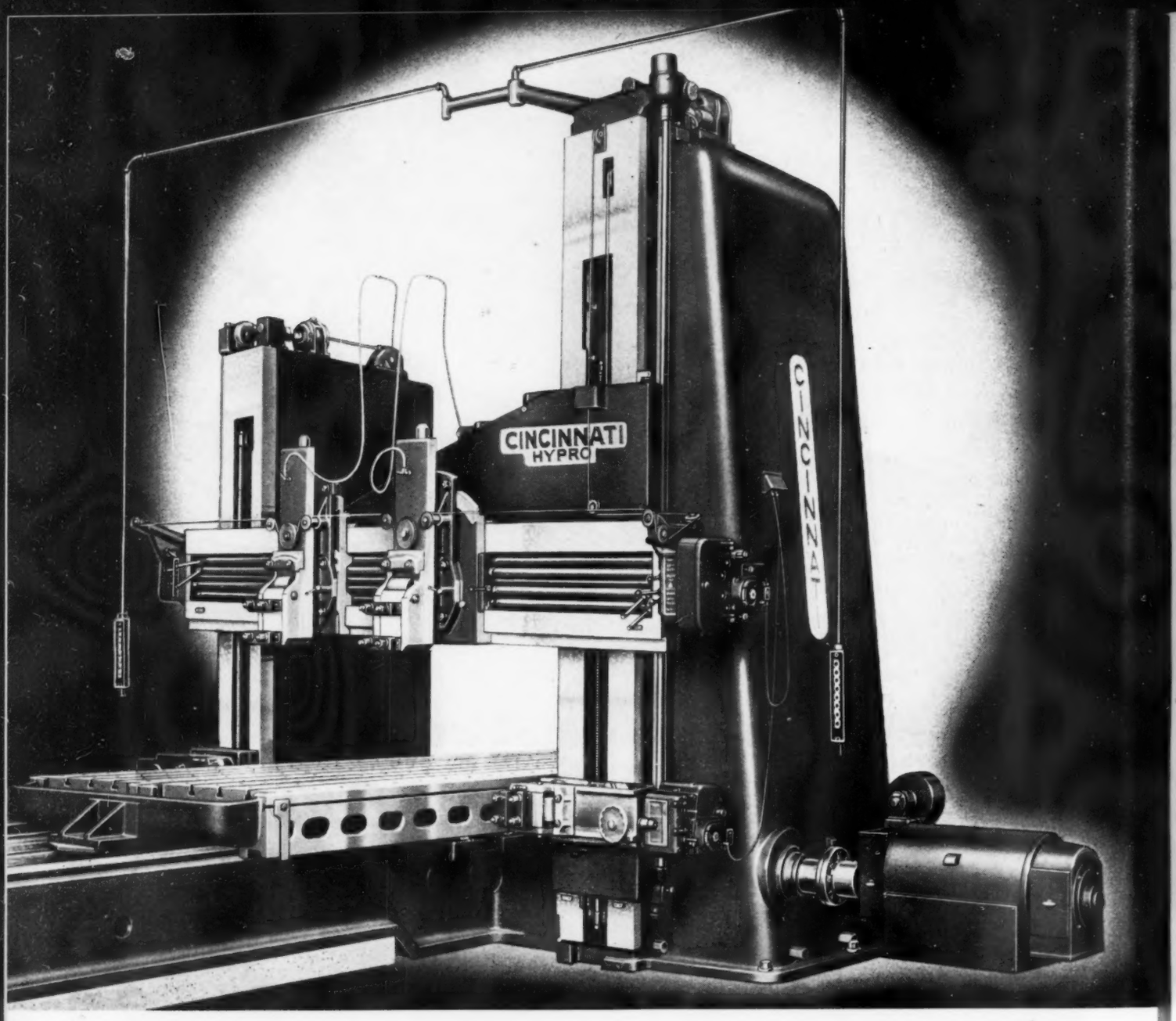
Carefully planned multiple tooling on standard heads results in less handling and much faster production. We will help you speed up and simplify your work by better tooling.

Mult-Au-Matic



THE BULLARD COMPANY

BRIDGEPORT CONNECTICUT



CINCINNATI HYPRO PLANERS

Help Supply More Ships for Allied Support • • • QUICKLY

• A Cincinnati Hypro Convertible Open Side Planer, size 132"x96"x40', is being used by a U. S. shipyard to machine large metal parts swiftly and economically. This planer is equipped with scarfing gears on the rail head to scarf armor plate. Note the auxiliary left-hand convertible column with side head attached. Machines like this are well adapted to machining ship parts due to their rigidity, flexibility and accuracy.

SPEED—POWER—CONVENIENT CONTROLS

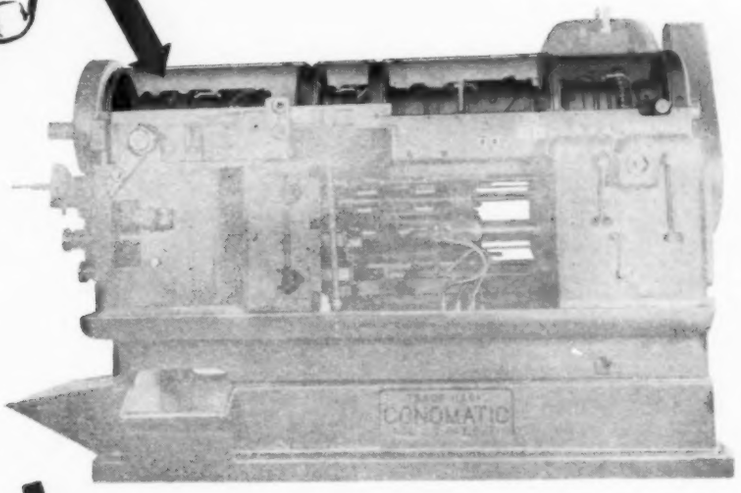
All contribute to the ease of operation and high production records of Cincinnati Hypro Planers. For complete information about Hypro Openside Planers write for Bulletin 110.

THE CINCINNATI PLANER COMPANY

Planers...Vertical Boring Mills...Planer Type Millers

CINCINNATI . OHIO . U.S.A.

YOU COULD FIND THEM IN A BLACKOUT



CONE CAMS ARE SO ACCESSIBLE

There is no question about the accessibility of Cone Cams. They are all on cam drums on *one* Camshaft, which runs the full length of the machine — in the rugged top bed, above the work area, free from falling chips and protected from dirt and foreign material.

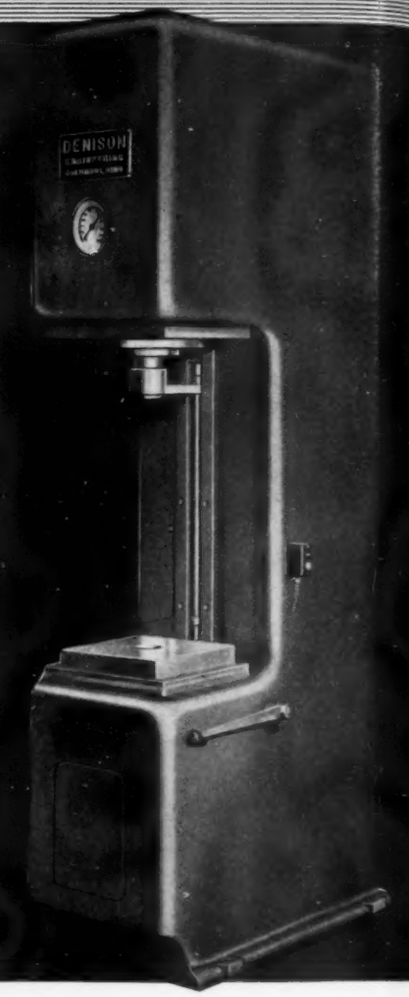
As this feature places Cone Cams always within easy reach of the operator, it facilitates quick changeover. The clear visual picture of the cams in actual operation assists the new operator to more quickly know his machine.

The Cone Over-Head Camshaft is but one of the advantages identifying Cone Departmental Design, and, from the time of its inception, has marked a step forward in multiple spindle automatic construction.

If your production-pulse needs priming it will pay you to specify Cones.

CONE AUTOMATIC MACHINE CO., INC.
Windsor, Vermont

A Versatile HydrOILic Press



Available in 5, 15, 25 and 50-ton capacities, this HydrOILic assembly press has set new standards in the design and performance of oil hydraulic equipment. It is completely self-contained and fully enclosed, yet extremely compact, requiring a minimum of space. The round-cornered, streamlined frame promotes high operating safety, for there are no projecting parts to injure the operator.

Its **oil hydraulic** operation makes it positive in action; the ram travels for as little or great a distance as the work requires — no more and no less. All principal moving parts operate in a bath of oil, giving you longer life at lower cost. Control is highly simplified, moving a lever or pushing a button is the only requirement, and dual controls can also be supplied for added safety.

Power is easy to adjust accurately from approximately 10% of capacity up to full capacity. Speed may be varied by using either controlled-orifice valves or variable-delivery pumps. Sequences of operations may also be handled automatically.

INDUSTRY'S NEW RIGHT HAND

OPERATION

When the ram is raised to the limit of the upstroke, the shipper rod holds the control valve in neutral position, and the pump and motor idle, consuming a minimum of HP. Downward movement of the control lever causes the shipper rod to rise, throwing the control valve into starting position. The ram then lowers until it reaches the limit of the down stroke (not standard on electrically operated press) which is controlled by a stop on the shipper rod. This forces the shipper rod down, moving the control valve into reverse position. The cycle is completed when the ram reaches the limit of the upstroke. Both the upper and lower stroke limits are adjustable by means of "stroke stops" on the shipper rod. If the descending ram contacts the work before reaching the lower stroke limit, it will continue to exert tonnage until the control lever is released. When the control lever is released, the ram returns to the upper stroke limit, completing the cycle.

EQUIPMENT FURNISHED

FOR MANUAL CONTROL — Press frame, cylinder and ram assembly, pump, oil reservoir, control valve, control valve operating mechanism incorporating provision for limiting the stroke in both up and down position, one control lever or pedal, pressure gauge, sub-bolster, and base and mounting for motor.

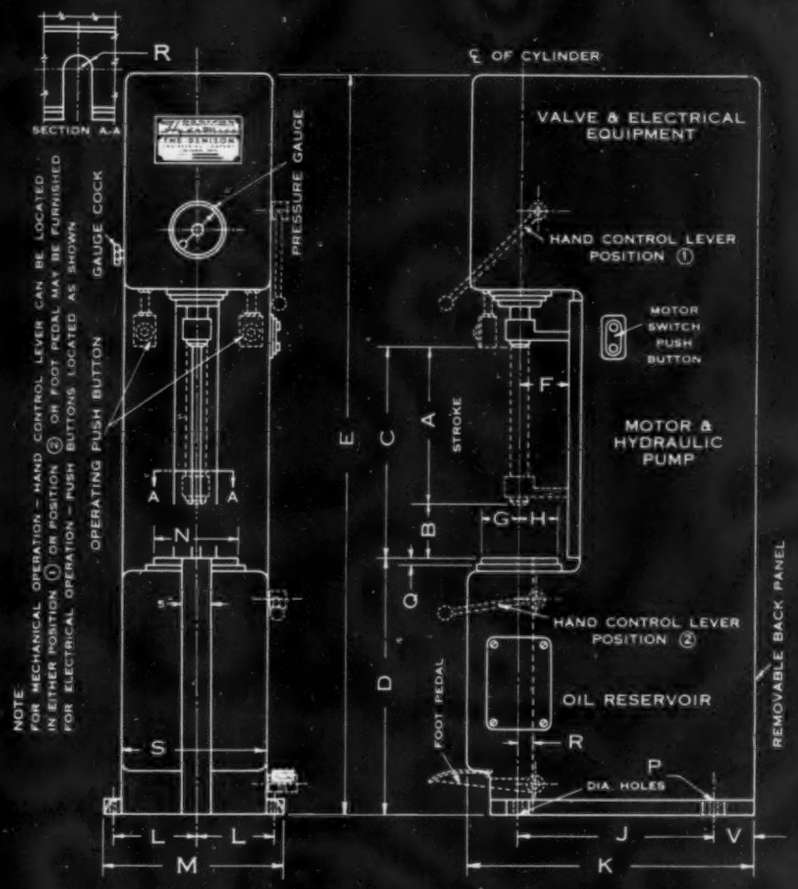
EXTRAS — The following items will be furnished with the above assembly at additional cost: standard bolster, additional operating controls, motor, starter and push-button and any other accessory purchaser may specify.

FOR ELECTRICAL CONTROL — Press frame, cylinder and ram assembly, pump, oil reservoir, solenoid control valve and control

WHEREVER YOU NEED POWER, SP

For Assembling – the DLAC2

	DLAC2-25		
A	12	18	24
B	6	6	6
C	18	24	30
D	35	35	35
E	94½	102	114
F	10	10	10
G	8	8	8
H	9⅛	9⅛	9⅛
J	36	36	36
K	52	52	52
L	13⅝	13⅝	13⅝
M	29	29	29
N	19	19	19
P	13/16	13/16	13/16
Q	2½	2½	2½
R	2½ R.	2½ R.	2½ R
S	25	25	25
V	6	6	6
W	6000	6100	6250
X	6050	6150	6300
Y	6150	6250	6400
Z	172	184	202


R
SECTION A-A
℄ OF CYLINDER
VALVE & ELECTRICAL EQUIPMENT
PRESSURE GAUGE
GAUGE COCK
OPERATING PUSH BUTTON
HAND CONTROL LEVER POSITION ①
MOTOR SWITCH PUSH BUTTON
MOTOR & HYDRAULIC PUMP
STROKE
HAND CONTROL LEVER POSITION ②
OIL RESERVOIR
FOOT PEDAL
REMOVABLE BACK PANEL
DIA. HOLES
NOTE
FOR MECHANICAL OPERATION – HAND CONTROL LEVER CAN BE LOCATED IN EITHER POSITION ① OR POSITION ② OR FOOT PEDAL MAY BE FURNISHED FOR ELECTRICAL OPERATION – PUSH BUTTONS LOCATED AS SHOWN

	DLAC2-25
MAXIMUM WORKING CAPACITY, TONS	25
CYLINDER BORE, INCHES	8.00
RAM SPEED, DOWN FT. PER MIN.	10
RAM SPEED, UP FT. PER MIN.	24
PUMP VOLUME, GALLONS PER MIN.	28
MAXIMUM WORKING PRESSURE P.S.I.	1000
MOTOR HORSE-POWER 1200 R.P.M.	15
RAM DIAMETER, INCHES	6.00
RAM THREAD, FEMALE, SIZE, PITCH	2-8
OIL RESERVOIR CAPACITY, GALLONS	50

valve operating mechanism incorporating provision for limiting stroke at top only (no hand or foot pedal controls), pressure gauge, sub-bolster, and base and mounting for motor.

EXTRAS — The following items will be furnished with the above assembly at additional cost: standard bolster, electric operating controls consisting of transformer, operating push-buttons and magnetic switches for solenoid where required, motor, motor starter, starter push-button and lower stroke limit.

NOTE:—Electrical Equipment furnished will be in strict accord with War Production Board Limitation Order L-147 which prohibits the specification of electrical equipment not approved by the American War Standards or approved by the Director of Industry Operations.

Priorities still have first call on HydrOILic Press output. But since conditions may change rapidly — even if only temporarily—we suggest you submit your requirements to us without delay. We'll tell you promptly the delivery we can make in your particular case. Write today, or call your Denison representative.

DO YOU HAVE THIS NEW PRESS CATALOG?

It gives you complete specifications on Denison's entire line of versatile standard HydrOILic Presses, including the model DLAC2 illustrated above. They're built in various capacities of up to 100 tons, and are readily adaptable to a wide range of pressing operations. The catalog also contains 12 full pages of the most frequently used engineering data — tabled and indexed for quick, easy reference. You'll want this catalog for your files!

WRITE TODAY FOR YOUR FREE COPY!

HydrOILic ASSEMBLY PRESS

CAPACITY 5 to 50 TONS

MANUAL OR ELECTRIC CONTROLS

MAX. WORKING PRESSURE 2000 P.S.I.

MAXIMUM STROKE 24″

MAX. THROAT OPENING 12″

MAX. VERTICAL OPENING 30″

The **DENISON** *Engineering Company*

1164 DUBLIN ROAD COLUMBUS, OHIO

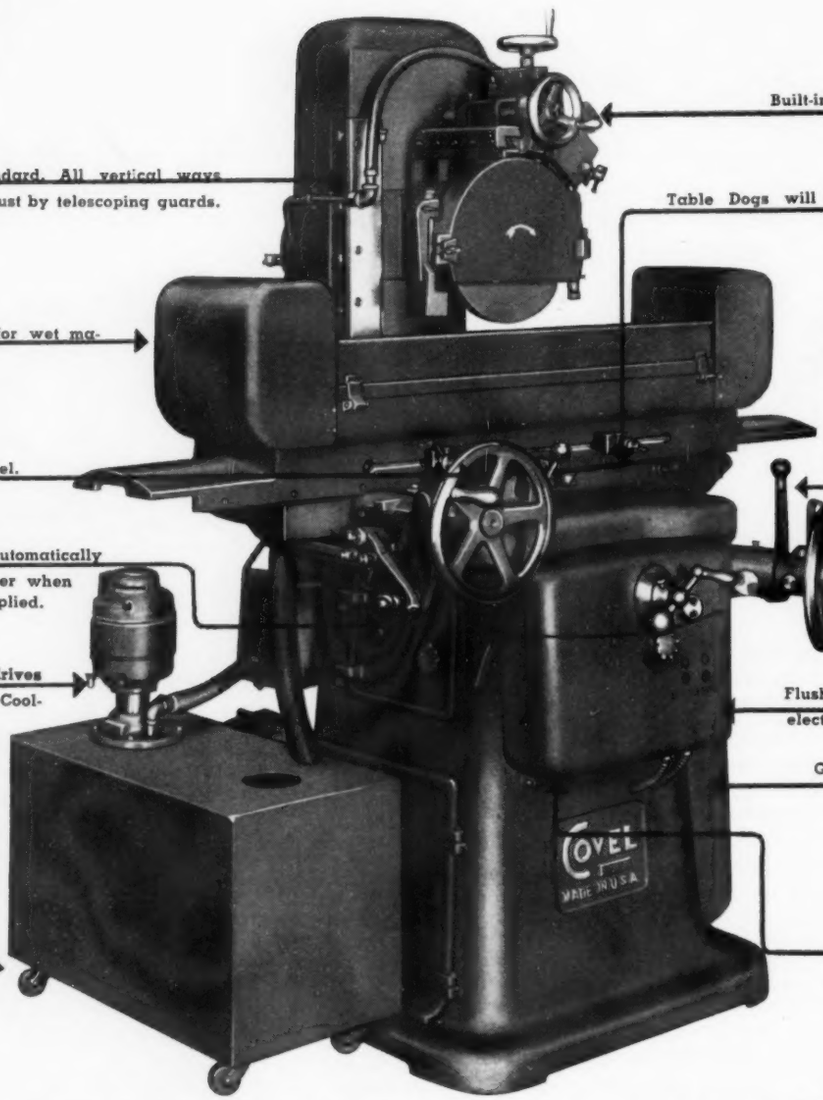
DENISON EQUIPMENT for APPLIED HydrOILics

and CONTROL CHECK

14 Star SERVICE FEATURES

—for PRECISION *PLUS* HIGH SPEED!

War production demands *precision* PLUS *high speed*. That's why these 14 STAR SERVICE FEATURES of Covel No. 5 Surface Grinder are appreciated by owners everywhere. Covel Bulletin 841 shows in detail why the No. 5 will increase your production, minimize rejects, and reduce costs on a wide variety of surface grinding jobs. Write today for your copy and name of nearest dealer.


Built-in Wheel-Truing Device.
One Piece Standard. All vertical ways protected from dust by telescoping guards.
Table Dogs will pass Throw-out Lever.
Splash Guards for wet machine.
Cross - Feed Shifter. Automatic Cross-Feed works both in and out and has automatic stop.
Hand-Feed Wheel.
Adjustable Pointer.
Throttle Lever automatically disengages power when hand-feed is applied.
Elevating Hand wheel, at working level. Graduations .0005", spaced 5/32" on rim.
Vertical Motor drives impeller type Coolant Pump.
Flush-type Push Buttons for electrical control.
Graduated Floating Dial.
COVEL
MADE IN U.S.A.
Large Tank for Coolant Mounted on Casters.
Dustproof Guard protects cross-feed adjustment mechanism.

Covel No. 5 Hydraulic Feed Surface Grinder (8" x 24") equipped for wet grinding

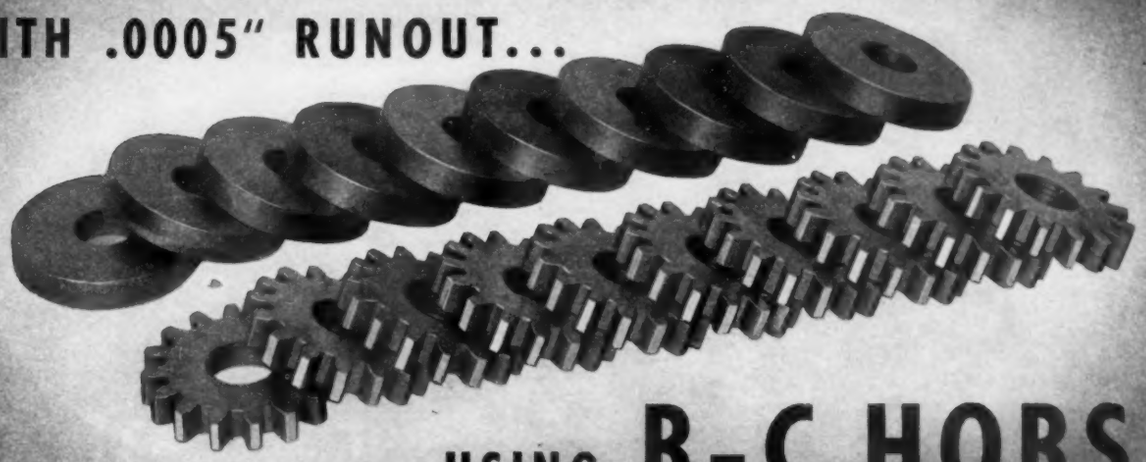
Grinding Machinery Since 1874

COVEL

COVEL MFG. CO., BENTON HARBOR, MICH.

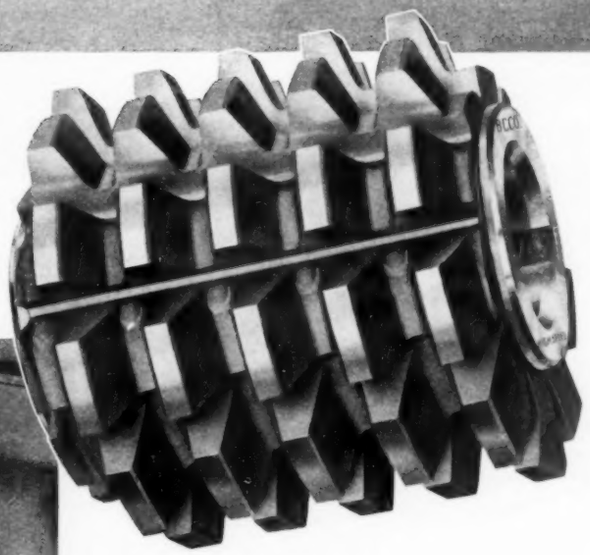
30 GOVERNOR PINIONS PER HOUR

WITH .0005" RUNOUT...

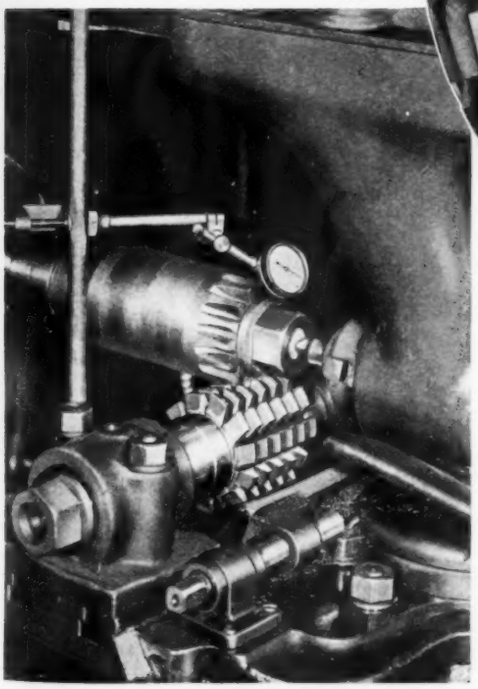


...USING B-C HOBS

Piece — Governor Pinion for Small Engine.
Material — Cast Iron, face ground for better truing-up on arbor.
Dimensions — 3.000"/2.995" O.D., ½" face, 16 teeth, 6 pitch, 14½° P. A., spur tooth.
Load — 10 pieces, on arbor.
Machine Set-Up — Hob speed 103 r.p.m. feed .050" per rev. of work, one cut.
Production — 20 min. per load.
Hob — B-C 3¼"x3¼"x1¼" hole, single thread, GROUND.
Hob is used in 2 settings, 100 pieces per setting, 200 pieces per sharpening.



These pictures were made in a plant now working on important war products. The job is an excellent example of the part which B-C Hobs and Hobbing Machines are playing in the manufacture of components which *must not fail.* This is only one of thousands of jobs where B-C products are active in war work.

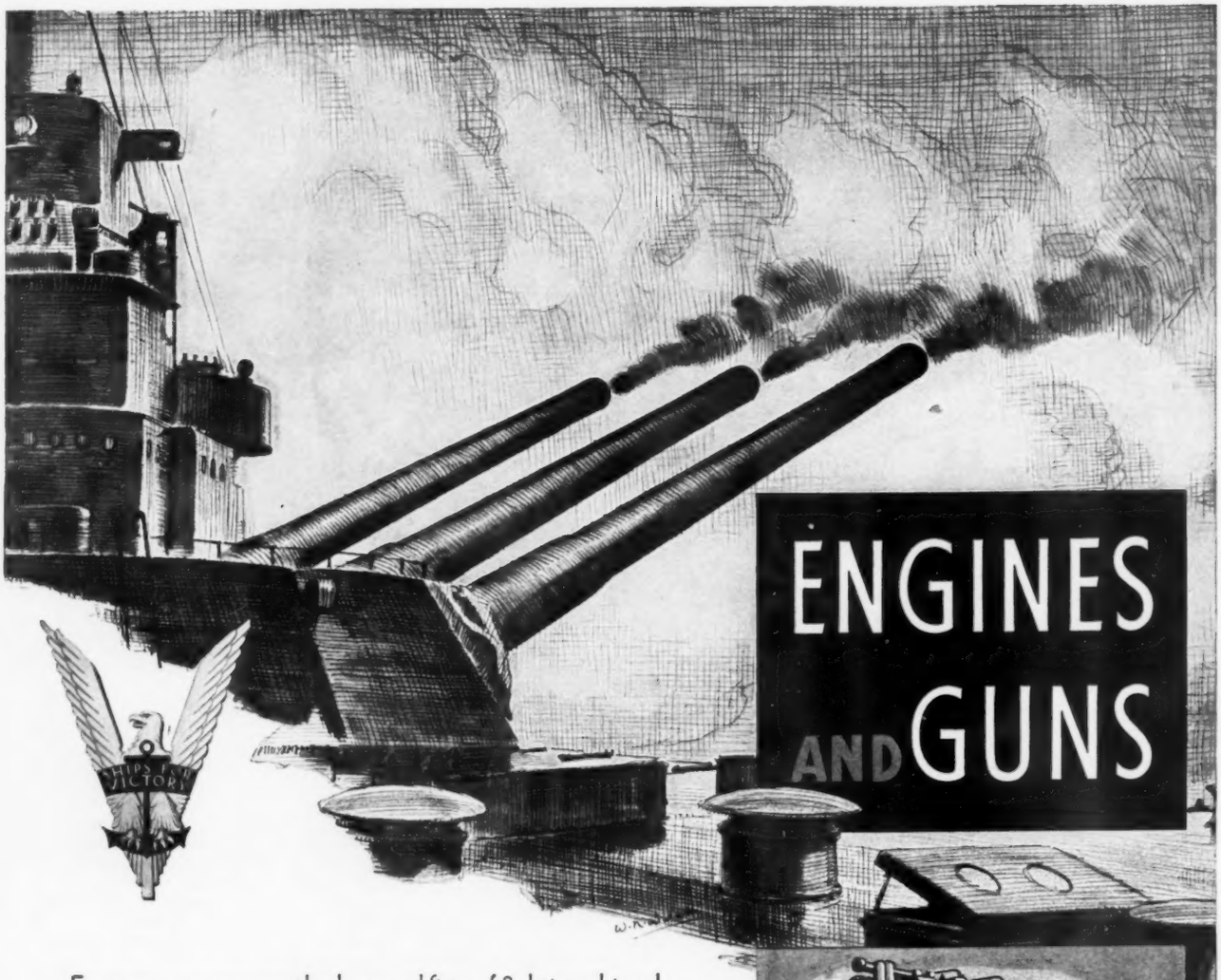


THESE cast-iron governor pinions for small engines are run in relatively small lots (100 at a time), but a high degree of accuracy is achieved as well as good production time. B-C GROUND Hobs are largely responsible for meeting the requirement of good finish at a production of 30 pieces per hour. Proper handling of the standard Barber-Colman Type "A" Hobbing Machine is responsible for meeting the accuracy tolerances of not over .0005" runout, and plus or minus .002" on pitch diameter measured over rolls. Where ACCURACY, PRODUCTION, and FINISH are all important, use B-C GROUND Hobs for greatest satisfaction.

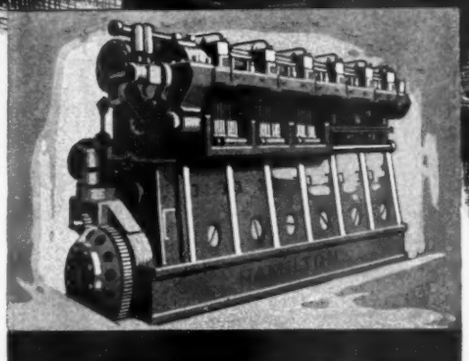
BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

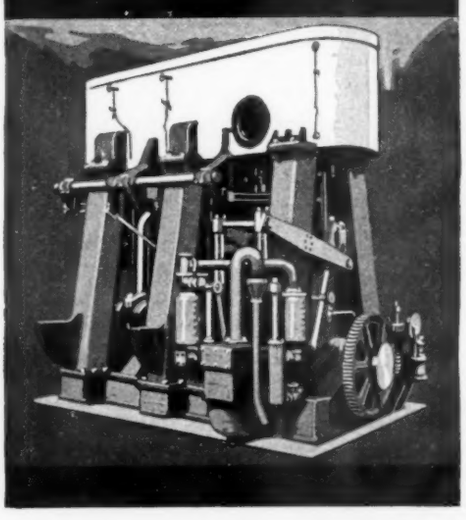
BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.



ENGINES AND GUNS





ENGINES AND GUNS are the legs and fists of fighting ships. In one of our plants we are turning out the engines. In another, many miles away, we are turning out the guns.

Other of our plants are working 'round the clock making machines to make guns, engines, armor plate and many another item essential to Uncle Sam's Armaments. All plants have been greatly expanded. But during this expansion the flood of Production has gone on without interruption. The 1942 total will be almost ten times that of 1939. We're on an all-out, full-time schedule, making the engines, guns and machine tools it takes to win the war and the peace that follows.

GENERAL MACHINERY
CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.
THE HOOVEN, OWENS, RENTSCHLER CO.
GENERAL MACHINERY ORDNANCE CORPORATION

P&J

PHOTO FURNISHED BY U. S. ARMY

AUTOMATIC CHUCKING EQUIPMENT
in the Arsenals of Democracy

are helping turn out more airplanes, airplane engines, tanks, Borfors guns, anti-aircraft guns, machine guns, adapters for shells, American Oerlikon guns

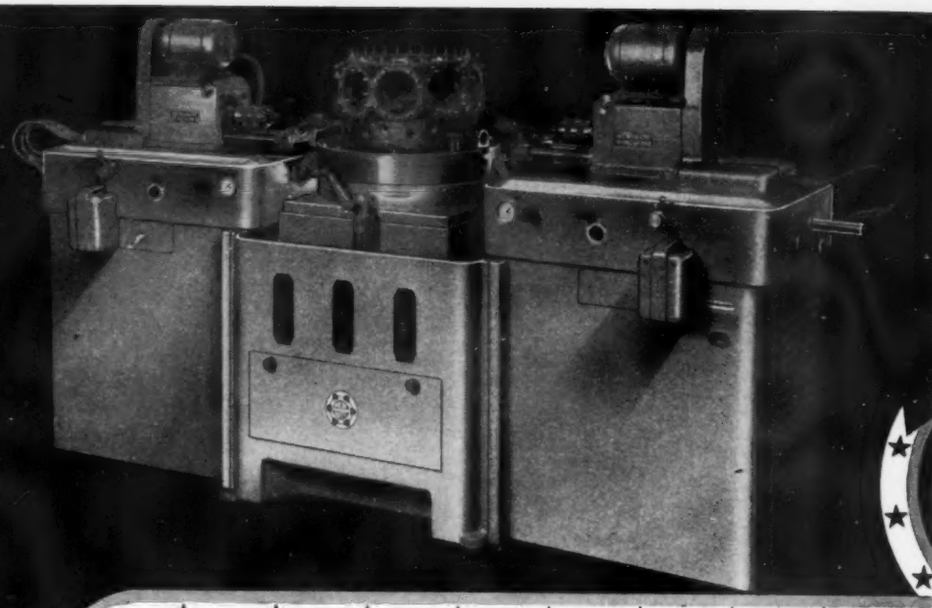
and many other vital war needs.

The call for war material in greater and greater quantities has thrown a load on metal working plants which is the obligation of machine tool builders to share.

We in the Potter & Johnston organization are happy to apply our specialized experience in duplicate parts production to the problem at hand. With machines that lend themselves to unusual tooling requirements and which are capable of outstanding performance and stepped up speeds, P&J engineers have been able to assist munitions manufacturers overcome many difficulties in production.

THE POTTER & JOHNSTON MACHINE COMPANY

PAWTUCKET, R. I.



Honing valve guides after assembly in crankcase (Radial Aircraft Engine) on Double End Hydrohoner with Micr-O-Size control—production 3 to 6 complete assemblies per hour—removes average of .0005" to .001" stock per bore—generates uniform size within .0003" to .0005", accuracy within .0001" to .0003" and surface finish within 3 to 5 micro-inches, r.m.s.

AIRCRAFT···—

AIRCRAFT···—

Feathering Oil Pump Gear Teeth (Aircraft Engine) external honing.

FOR VICTORY PRODUCTION

SAVE TIME

SAVE METAL

SAVE COST

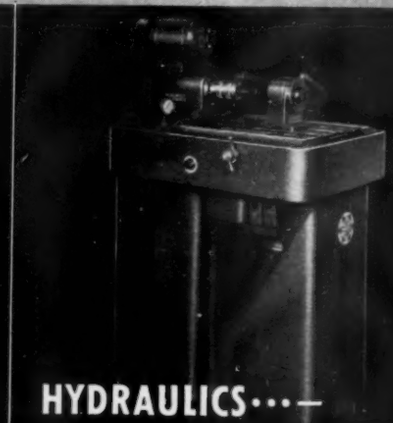
IMPROVE QUALITY

AIRCRAFT···—

Honing Piston Pin Bores (Aircraft Engine).

AIRCRAFT···—

Honing Valve Guides (Aircraft Engine) before assembly.



HYDRAULICS···—

Honing O.D. of pistons for a variable delivery pump.

Honing cast iron valve guides on full automatic Hydrohoner with Micr-O-Size control—Production 250 pieces per hour. Average Stock removed, .0015" to .0025"—Size within .0005" tolerance; accuracy within .0001" to .0002"; surface finish within 3 to 5 microinches, r.m.s.

Honing Piston Pin holes (in Piston) on Double Spindle Hydrohoner with Micr-O-Size control.

AUTOMOTIVE···—

Microhoning has been adopted in most armament production shops to speed up the final processing operation on vital bearing surfaces.

Microhoning generates final surfaces with the minimum amount of stock removal.

Microhoning saves sufficient processing time and cost in some installations, it is reported—even *to pay for the machine in 30 to 40 operating days.*

Microhoning controls cutting pressure, speed and motion to produce maximum obtainable quality of generated surfaces.

Write for Bulletins AR60 and AR64 for further details.

MICROMATIC HONE CORPORATION

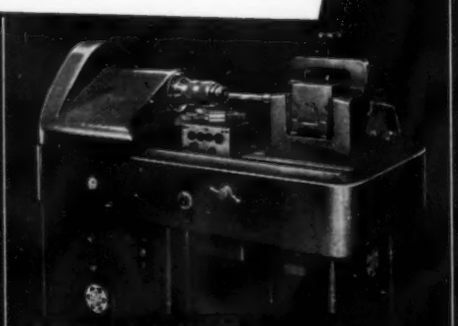
1345 E. MILWAUKEE AVE. DETROIT, MICHIGAN

ORDNANCE···—

Double Spindle Hydrohoner with Micr-O-Size control for honing gun charger tube bores.

HYDRAULICS···—

Honing blind end bores in a variable delivery pump body.



HYDRAULICS···—

Honing bores in hydraulic valve body on Micromatic Hydrohoner.

ORDNANCE···—

Honing pinion shaft bores in hardened planetary gear for military vehicle.

TO YOU . . .
WHO HELPED US WIN THE ARMY-NAVY "E"

WE are proud of the flag now flying above our plant; proud of the Army-Navy "E" pins we are privileged to wear. But, in all fairness, we feel those honors should be shared with you — the users of "G.T.D. Greenfield" tools — Taps, Dies, Gages.

Your patronage made us grow. Your loyalty inspired our progress. That is why War found "G.T.D. Greenfield" ready. When the hour struck, we had both the equipment and the skill necessary for greatly increased output of tools for the building of modern war weapons.

Now, "for the duration," we pledge ourselves to any sacrifice that Victory may demand. Harder work. Better work. Ever increasing production. And we are helped in this resolve by the knowledge that in this crisis, as in the past, we have your backing and co-operation.

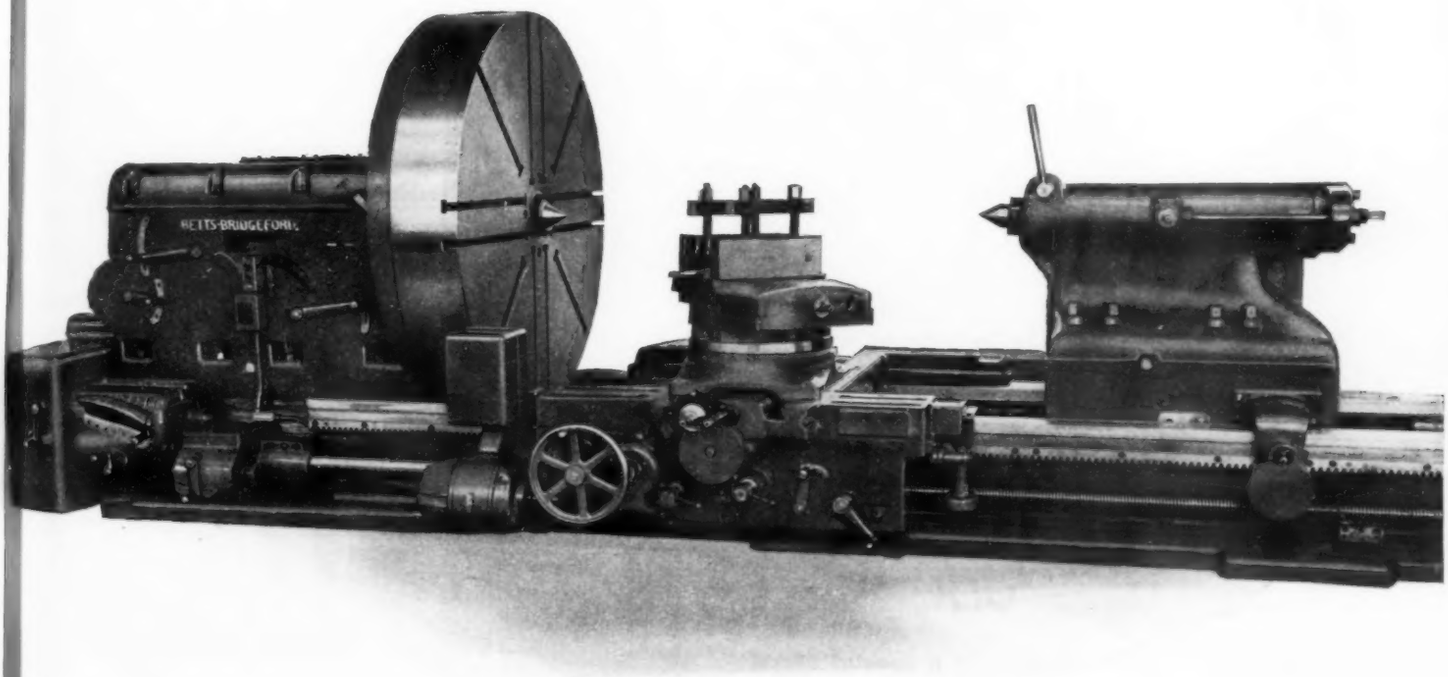
GREENFIELD TAP AND DIE CORPORATION
GREENFIELD • MASSACHUSETTS
DETROIT PLANT: 5850 Second Boulevard
WAREHOUSES in New York, Chicago and Los Angeles
In Canada:
GREENFIELD TAP AND DIE CORP. OF CANADA, LTD., GALT, ONTARIO

GTD GREENFIELD
TAPS · DIES · GAGES · TWIST DRILLS · REAMERS · SCREW PLATES · PIPE TOOLS

BIG LATHES

BETTS-BRIDGEFORD

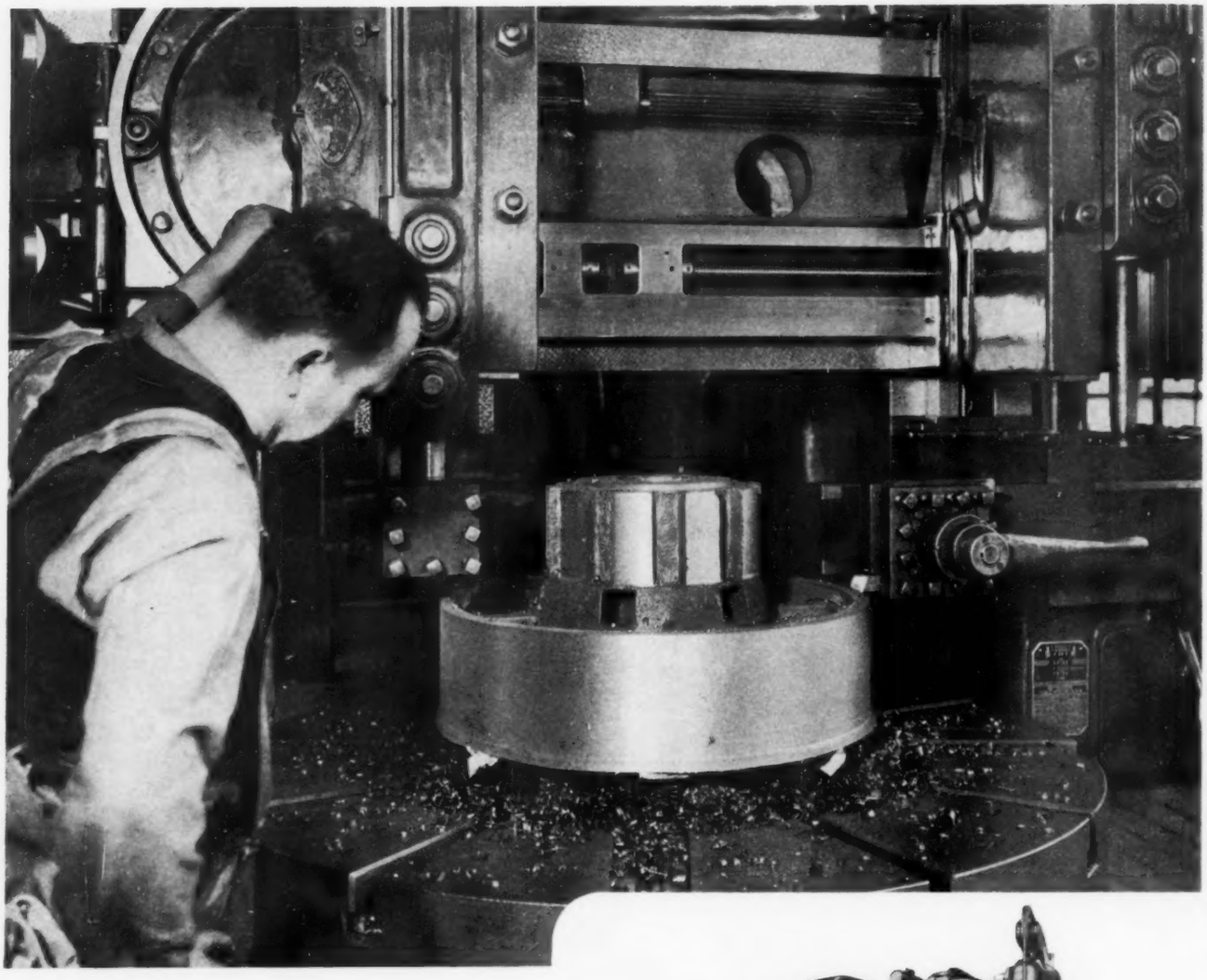
A name universally recognized as the leader in medium and large Engine Lathes for fast and economical production.



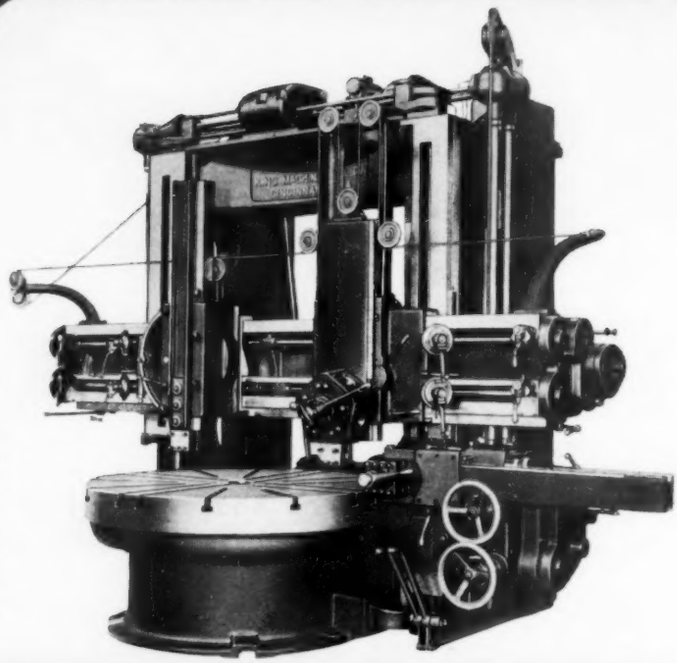
The machine shown above is a 72" x 50' between centers, Betts-Bridgeford Geared Head Lathe, shipped recently to one of the large Electric Companies for war production work. Other sizes of standard lathes and Combination Gun Boring and Turning Lathes are being built and shipped as rapidly as possible to be used in the production of war essentials.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK



An Intimate View of a **KING** *at Work*



● Boring a 7" hole 12" deep in a special nickel alloy casting is only one of many jobs being handled on this King Boring and Turning Machine. Two set ups are required—first rough bore inside diameter, rough and finish turn face—second finish bore, finish outside diameter and rough and finish opposite face. Time approximately 14 hours. . . . On your boring, turning, facing and similar operations specify a King Boring & Turning Machine for greater production, faster and low costs.

The KING MACHINE TOOL *Company*

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

TO LEFT: 39-A Internal—one of nine modern styles of Ex-Cell-O Standard Precision Thread Grinders being widely used today by war production industries.

BELOW: Precision grinding internal thread on aircraft part, typical of thousands of war production parts being accurately, speedily and economically ground on Ex-Cell-O precision thread grinders.

TODAY'S PRODUCTION CALLS FOR EX-CELL-O PRECISION

Ex-Cell-O's wide experience in designing and building precision machine tools makes Ex-Cell-O engineers exceptionally familiar with production requirements in today's emergency. Take, for instance, precision thread grinding, almost indispensable in the aircraft and other war industries where hardened threaded parts must be finished to the highest degree of accuracy. Ex-Cell-O engineers have designed nine standard thread grinders—automatics, universals, plain production machines. This variety in style and the flexibility in use of these Ex-Cell-O machines enable a manufacturer to select a standard machine that will meet specifically his exact thread grinding requirements today and provide him with equipment that can be readily and profitably adapted to production of civilian needs tomorrow. Because of their soundness in design, their thoroughness in construction, their simplicity and efficiency of operation, and their modern styling, Ex-Cell-O standard thread grinders are proving the first choice of America's war production industries.

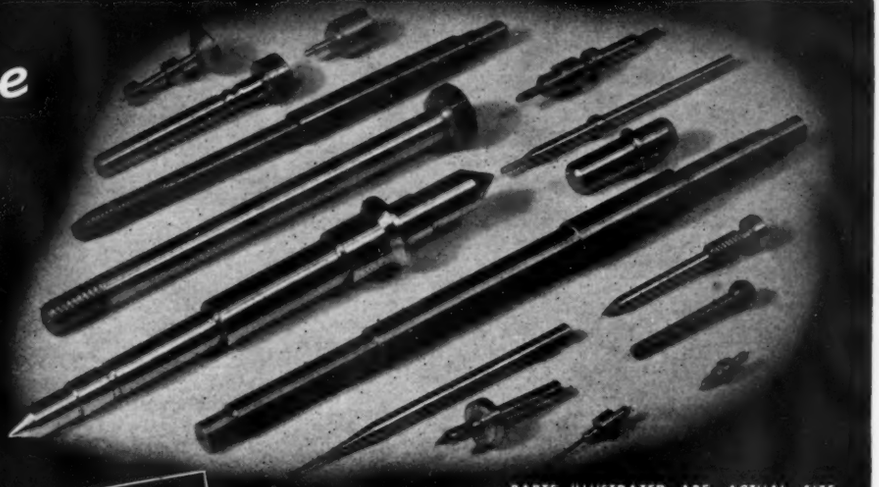
EX-CELL-O CORPORATION • DETROIT

XLO

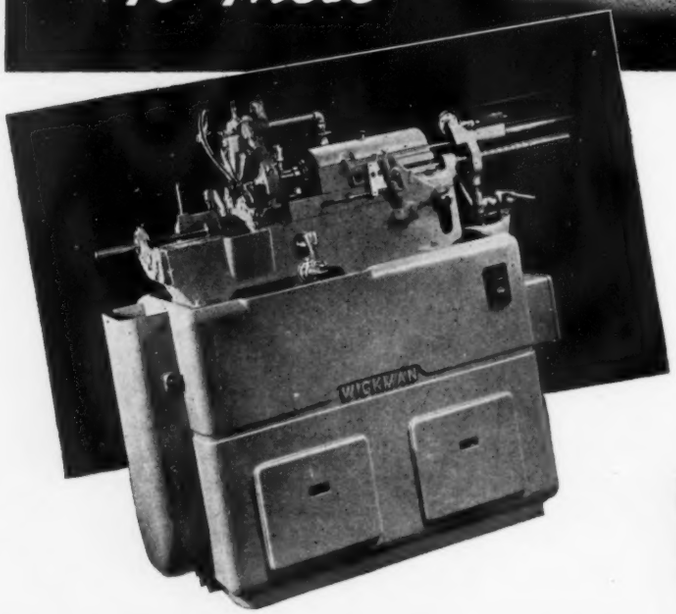
EX-CELL-O *means* PRECISION

THREAD GRINDING, BORING AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC POWER UNITS • GRINDING SPINDLES • BROACHES • CUTTING TOOLS • DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS • PRECISION PARTS

If You Are Producing Parts Similar To These

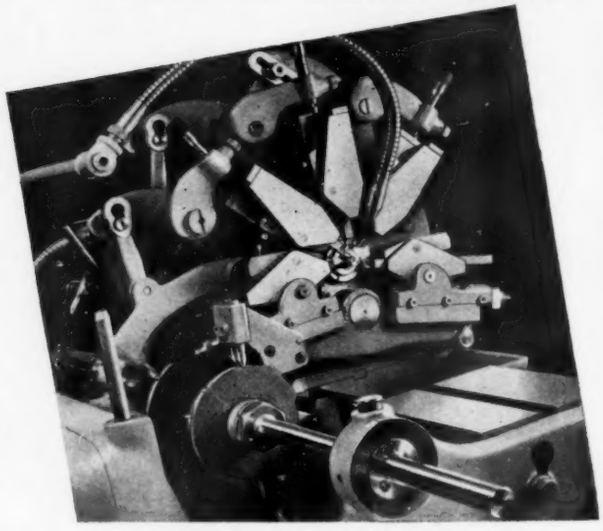


PARTS ILLUSTRATED ARE ACTUAL SIZE AND ARE PRODUCED IN ONE OPERATION



This Machine Can Give You

• UNEQUALLED ACCURACY • FINISH • CONCENTRICITY • MAXIMUM PRODUCTION



The Wickman High Precision Automatic is a precision built machine designed especially for the production of small, accurately-finished parts from bar stock on a high production basis.

Its principal features are the sliding headstock, work guide bushing, and the rigid tool head carrying five individually-fed tools. The bar stock is fed through the guide bushing to the tools by the sliding headstock and all movements of the headstock and tools are controlled by cams. All tool holders are provided individually with both radial and lateral micrometer adjustments.

Single point tools are employed and, because of the unique design of the machine, there is almost no limitation to the scope of the back shoulder work which can be done, thereby eliminating any need for second operations.

SPECIFICATIONS
for No. 2 High Precision Automatic Illustrated

½" Collet Capacity • 4" Maximum Turning Length
28 Spindle Speeds up to 7000 R.P.M.

Full Details Will Be Sent You Immediately Upon Request

WICKMAN HIGH PRECISION AUTOMATIC

(SWISS TYPE)

THE Wickman CORPORATION

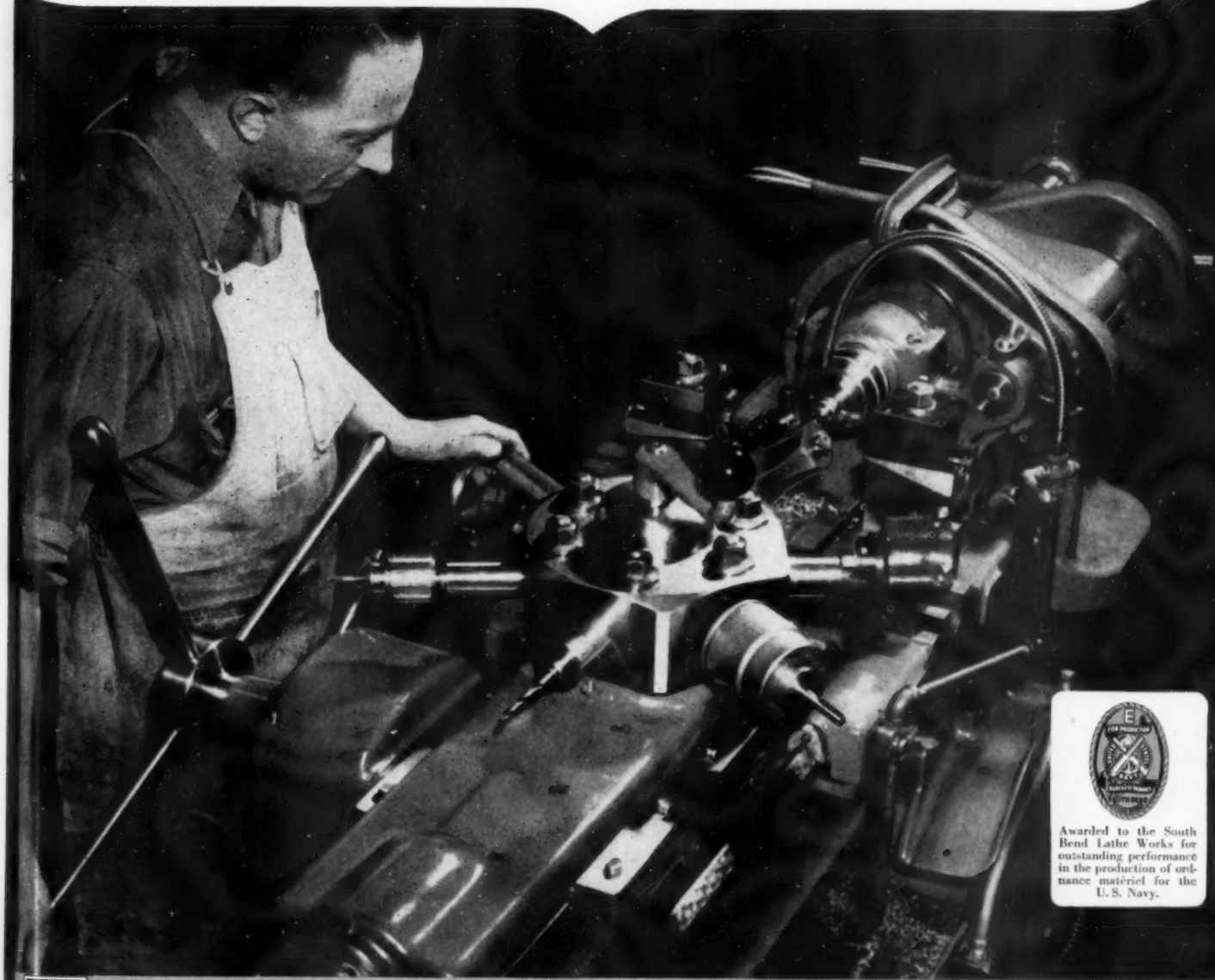
15539 WOODROW WILSON AVE.
DETROIT, MICHIGAN

KEEPING PRECISION IN PACE WITH PRODUCTION

War production is urgent—that's certain. But production *without precision* is wasteful, even though quantities may be large and deliveries rush. Today, in hundreds of war production plants, precision keeps pace with production through the use of South Bend No. 2-H Turret Lathes.

Features responsible for the efficient performance of these Turret Lathes include an exceptionally rigid turret and carriage construction—a quick change gear box providing a wide range of power feeds for the universal carriage and turret—complete thread cutting range through lead screw and split nut, and a wide selection of spindle speeds.

The No. 2-H Turret Lathe has 16″ swing, 1⅜″ spindle hole, and 1″ collet capacity. South Bend Turret Lathes are also available in smaller sizes. Toolroom and Quick Change Gear Lathes are manufactured in 5 sizes, 9″ to 16″ swings. Write for information, specifying sizes and types of lathes in which you are interested.



Awarded to the South Bend Lathe Works for outstanding performance in the production of ordnance matériel for the U. S. Navy.

SOUTH BEND LATHE WORKS

Dept. 952, South Bend, Ind., U. S. A. *Lathe Builders For 35 Years*

How much skill needed here?

. . . for efficient production here?

THE primary advantage of the Gisholt Hydraulic Automatic Lathe is its high productive capacity. But in these days when skilled hands are in such demand, the extreme simplicity of this machine is doubly important! With but a single control, it performs the complete cycle of machining operations.

Where the machine itself has the inherent skill to produce quickly and accurately, the hands don't need it. Gisholt Machine Company, 1201 E. Washington, Madison, Wis.

GISHOLT

LOOK AHEAD • KEEP AHEAD • WITH GISHOLT IMPROVEMENTS IN METAL TURNING

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

U N I O N

THE *Complete* LINE

War production demands perfection in every metal-working job—so choose your tools from the complete Union Line. Now, when aircraft and munitions jobs are making their greatest demands on tools and machines, it is Union fine tool features . . . Union high metallurgical standards . . . Union ruggedness and accuracy that are making them—more than ever before—The Tools You Buy Again.

TWIST DRILLS—MILLING CUTTERS
GEAR CUTTERS—HOBS—SAWS—TAPS
REAMERS—END MILLS
DIES—SCREW PLATES

Union Butterfield Card

UNION TWIST DRILL CO.
ATHOL, MASS.

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
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STORES

New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 6540 Antoine St.
San Francisco: 121 Second St.
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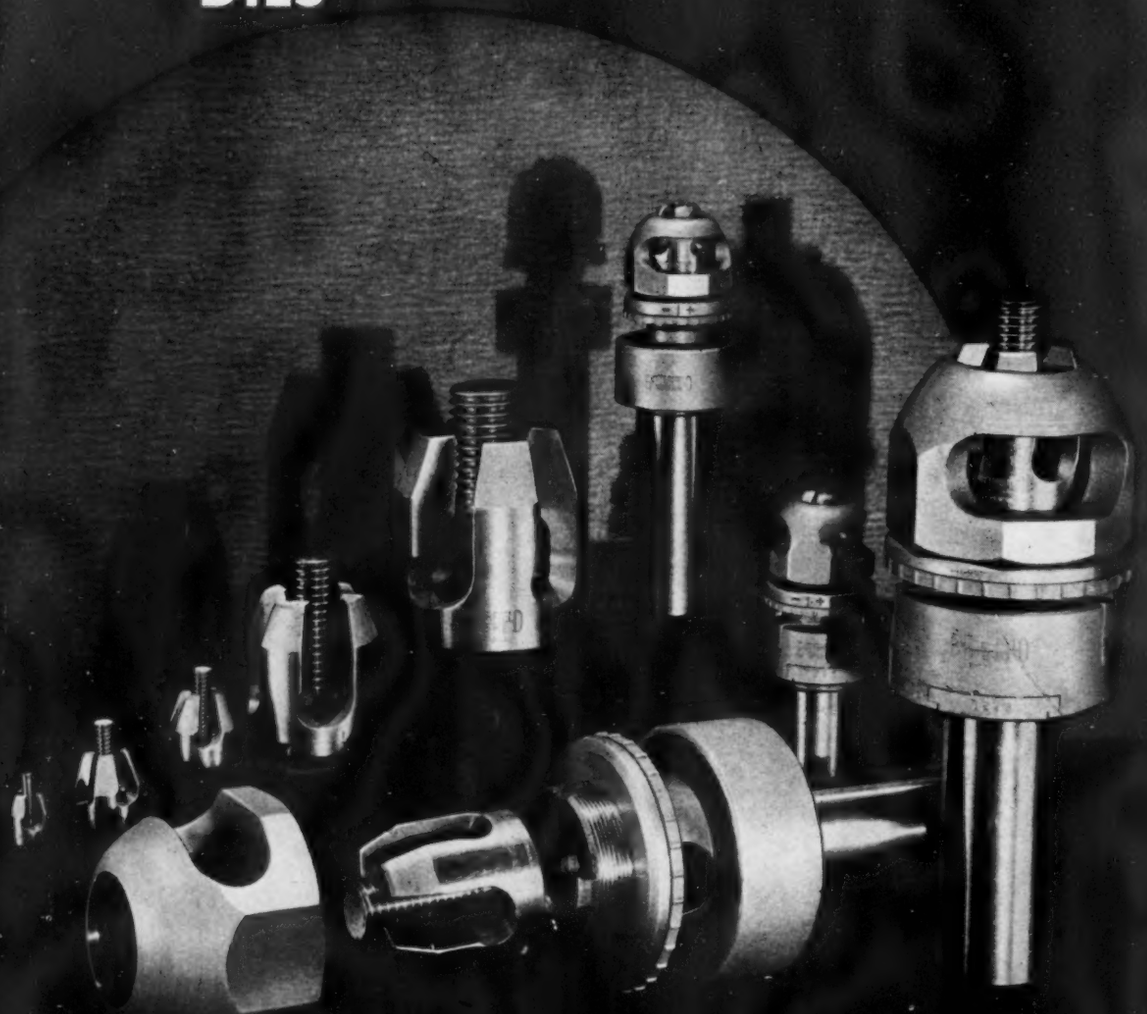
Seattle: 568 First Ave., South

Divisions of the
UNION TWIST DRILL CO.

Butterfield

THRED-RITE DIES



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for Service!

CARD

The Card Emblem has always been a reliable guide to efficient tools for producing accurate threads, and present war production demands find Card ready with tools to do the job. Today, more than ever before, higher standards of accuracy and tougher, harder materials call for superior tools. In plants engaged in top-speed war production, results are proving the wisdom of using the Card Emblem as a guide to real tap service!

t erfield Card

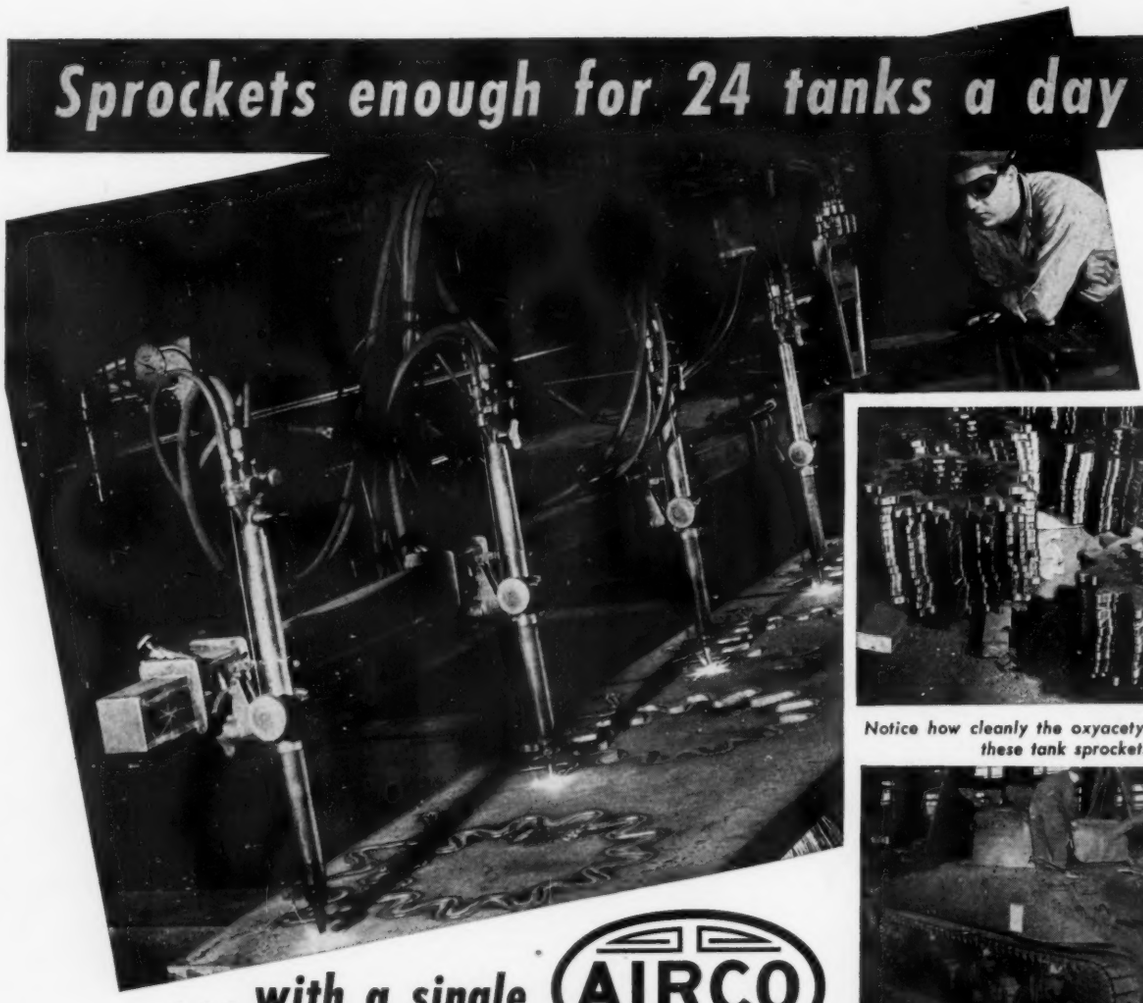
Divisions of the UNION TWIST DRILL CO.

S. W. CARD MFG. CO.
MANSFIELD, MASS.

STORES

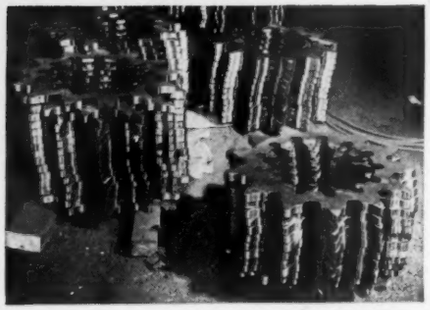
New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 6540 Antoine St.
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South

Sprockets enough for 24 tanks a day . . .



. . . with a single AIRCO

GAS CUTTING MACHINE



Notice how cleanly the oxyacetylene flame cuts these tank sprockets.

Thousands of tanks like these will soon be taking their place in our armored forces — thanks, in part, to the time-saving production that oxyacetylene cutting makes possible. Photo courtesy U. S. Army Signal Corps.

At this plant production of vital tank parts like these drive sprockets is keeping well ahead of the huge tank-building program, thanks to this Airco Travograph. In only twenty minutes, this machine accurately cuts both the inside and outside peripheries of four identical drive sprockets. Simply by changing the template which guides the torches, this machine can be made to cut many other shapes. For cutting one or few parts, not even a template is necessary, when the Travograph is equipped with a manual tracing device.

This typical example of stepped-up production is only one of many ways in which the oxyacetylene flame is helping to produce our country's arms more quickly and economically than ever before. The oxyacetylene flame prepares with speed and accuracy plate edges for both arc and gas welding. It hardens steel to any desired depth . . . cleans metal surfaces to assure long lasting paint jobs, resistant to rust and corrosion.

Air Reduction's wartime policy is to help American industry do the tough job we all face. Our nationwide field engineering service and our research facilities are at your disposal to supply "know how" information on any problem involving the use of the oxyacetylene flame and the electric arc.

Air Reduction

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

IN TEXAS
MAGNOLIA-AIRCO GAS PRODUCTS CO.
General Offices: HOUSTON, TEXAS
OFFICES IN ALL PRINCIPAL CITIES

AIRCO WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

Announcing
THE IMPROVED 1/4 INCH
SKILDRILL

- **RUNS QUIETER**
- **STAYS COOLER**
- **DRILLS HOLES FASTER!**

If you've seen SKILDRILL or heard about the thousands of SKILDRILLS in war plants, you know it's perfect for easy, top-speed, day-long drilling. And now you should know that SKILDRILL has been improved... with new special features that put it even farther ahead of every other 1/4-in. drill in the market!

We improved the gearing... made SKILDRILL run quieter than ever without adding an ounce to its easy-handling 2 3/4 lbs.!

We stepped up the cooling system... made this *cool* drill run COOLER without making it bigger (only 2 9/16 in. wide and 6 5/8 in. long). And we offer SKILDRILL in 4 SPEEDS to give you peak performance on whatever material you use... to speed up every production drilling job in your plant. Ask your distributor to demonstrate new, *improved* SKILDRILL today!

THESE SPECIAL FEATURES

- New Quieter, Smoother Gearing!
- New Improved Cooling System!
- 4 Speeds Available!

For fastest drilling on any material
1800 R.P.M. 2500 R.P.M.
3500 R.P.M. 5000 R.P.M.

$32.50

SKILSAW, INC. 5059 Elston Ave., Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
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SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

INCREASE PRODUCTION, CUT YOUR COSTS WITH CLEVELAND *Single Spindle* AUTOMATICS AS THEY DO AT THE HEIL COMPANY PLANTS

HEIL PRODUCTS

LET'S GO! U.S.A. KEEP 'EM FLYING!

• After investigating the possibilities of Cleveland *Single Spindle* Automatics, The Heil Company decided to produce the part shown at the left in quantities of 5,000 to 10,000 pieces on a 2 1/2-inch capacity Model A Cleveland. It had previously been produced by other methods requiring more machines and operators.

As forecast by our engineers and time-study men before installation of the Cleveland Model A, costs immediately dropped to a pre-determined point, and stayed there. Production increased. Five operations are performed on this part. "Very satisfactory; operation is perfect up to date," says the company.

Provided with 4-speed motor drive in 3 3/4-inch to 8-inch sizes, Model A has universal camming and variable tool feed. In 1 1/16-inch up to 2 1/2-inch sizes Model A has constant speed motor drive, with 2-speed drive optional at slight extra cost. A Bulletin describing the size you might require will be sent on request.

THE CLEVELAND AUTOMATIC MACHINE COMPANY
2269 ASHLAND ROAD • CLEVELAND, OHIO

Sales Offices: CHICAGO: 565 W. Washington Street • DETROIT: 540 New Center Building
NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**

Three of 26 Model B Cleveland *Single Spindle* Automatics used by Packard Motor Car Company in Rolls-Royce aircraft engine parts production.

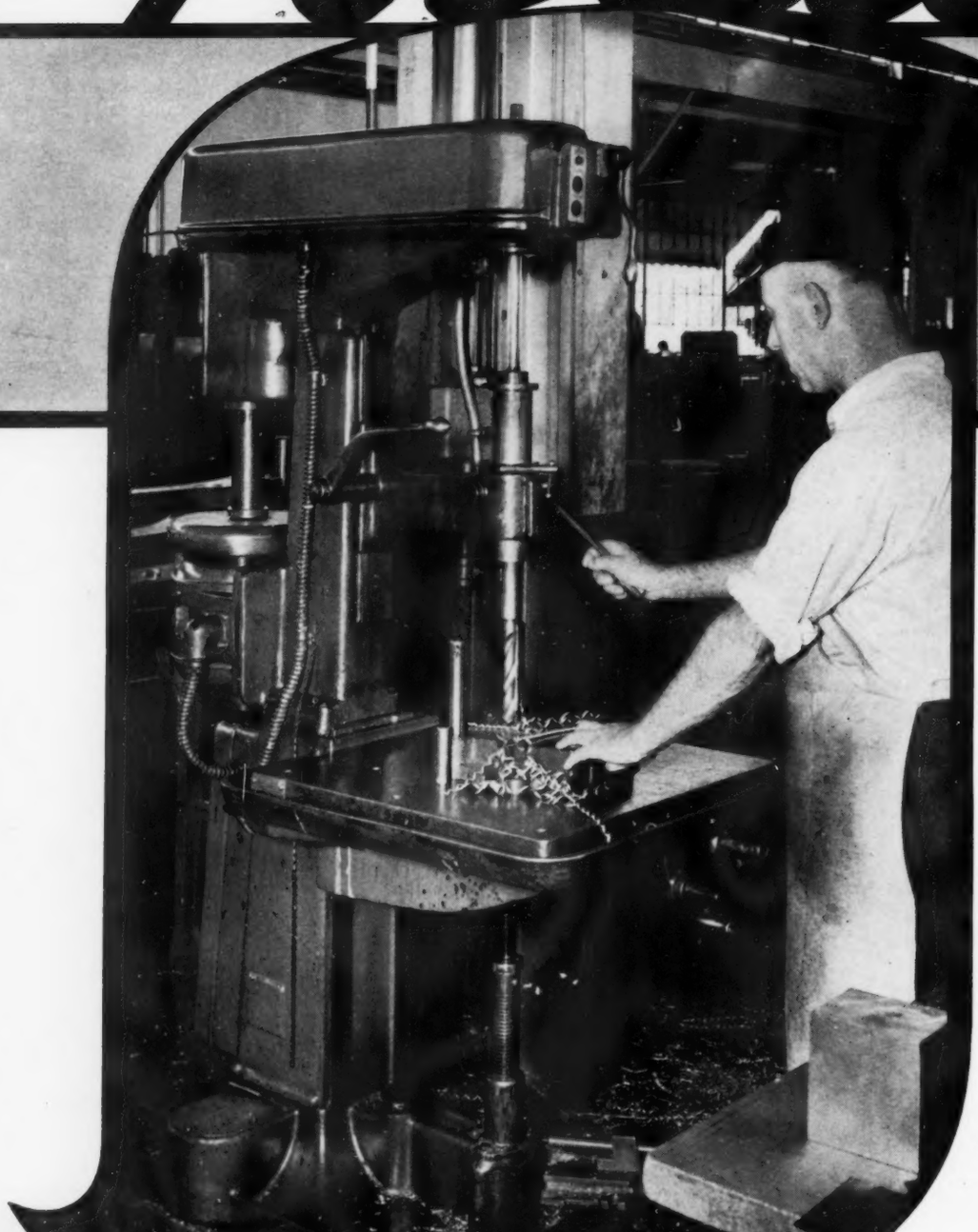
One of the 2½-inch Cleveland Model A *Single Spindle* Automatics producing locomotive stay bolt sleeves for Canadian General Electric Co., Ltd.

CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 9/16-inch to 8-inch capacities inclusive

MODEL B—Built in 9/16-inch to 2½-inch capacities inclusive

Fosdick



HIGH SPEED SENSITIVE DRILLS

are

"TOOLING UP" INDUSTRY

for

"All Out" War

Practically every plant with War contracts is working on "round-the-clock" schedules. Production—better and faster is the crying need to keep our widely scattered forces amply equipped.

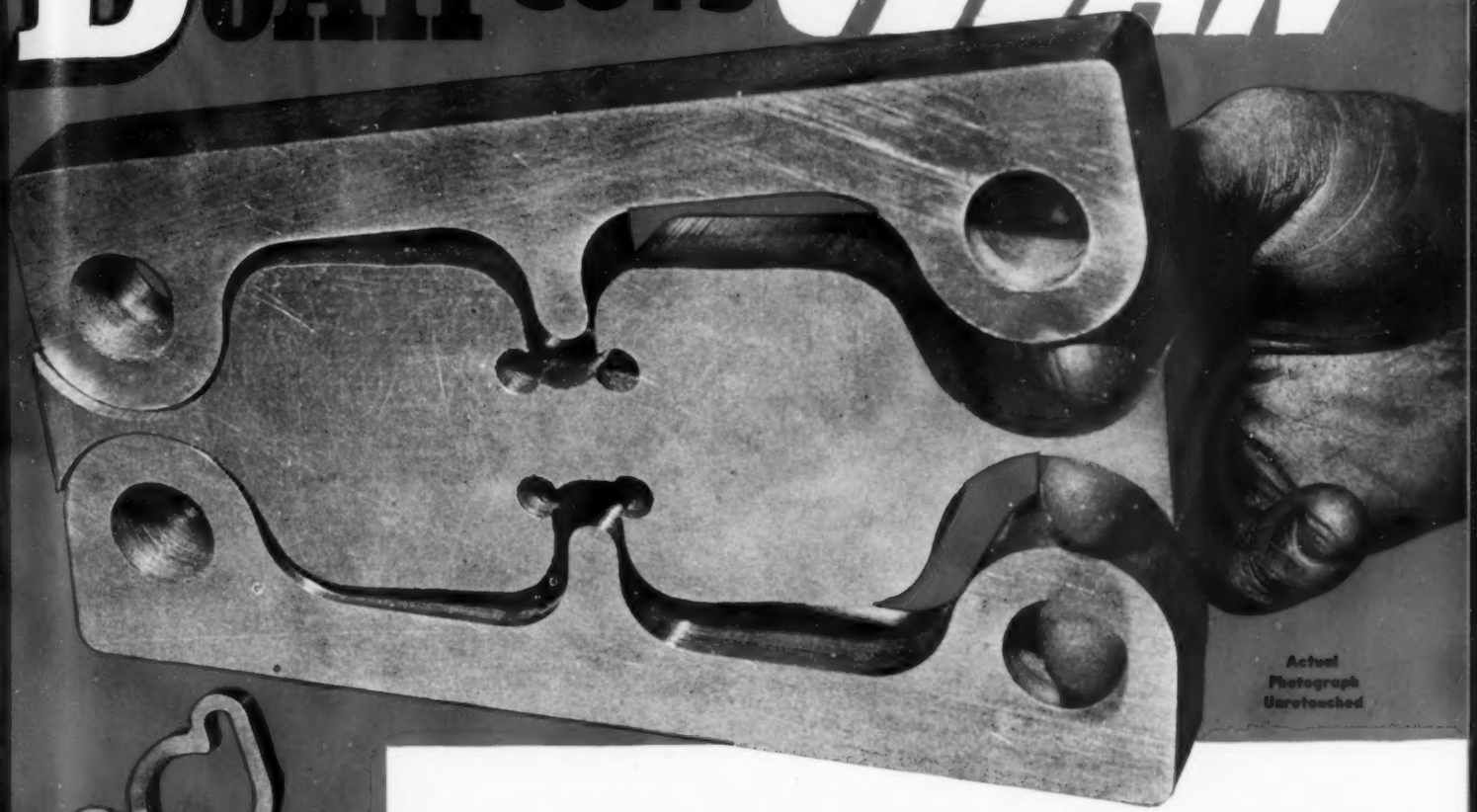
Fosdick High Speed Drills in hundreds of Tool and Die Shops in all parts of the country are performing drilling—reaming—boring and tapping operations on all types of dies—tools—jigs and fixtures essential to speeding up war production.

Illustrated is a Fosdick High Speed Sensitive Drill doing its part toward "tooling up" Industry for "all out" war in a midwest tool and die shop.

For economical—fast drilling of holes up to 1¼" put the job on a Fosdick High Speed Sensitive Drill. Full particulars will be found in High Speed Drill Bulletin—H.S.A. Write for one.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ··· OHIO

DoAll cuts CLEAN



NO FINISHING IS NECESSARY

That's right—on the DoAll you can cut out thousands of metal parts and they're all *ready* for *use*. Follow the line of any external or internal design and get a smooth finish that requires *no further machining*.

UNSURPASSED FOR RAPID, ECONOMICAL

PRECISION SAWING

Whether it's special parts or regular production work—20 to 80 stacked sheets, bar or tubing stock, blocks of any thickness—the DoAll saves uncountable man-hours and much valuable machine time.

DoAll supremacy is aided by the 48 different saw bands available—a best style for every kind of metal or alloy.

Then, consider the metal saved—very important today. DoAll leaves waste metal in large, usable pieces, not in a heap of filings or nibbled chips.

LET US PROVE THESE FACTS TO YOU. A factory-trained man will call with a DoAll and show you how it will save you time, labor and metal.

New Illustrated Book—The story of DoAll performance in many plants, told in pictures. Send for copy.

CONTINENTAL MACHINES, Inc.
1310 S. Washington Ave., Minneapolis, Minn.
Associated with the DoAll Company, Des Plaines, Ill.
Manufacturers of Band Saws and Band Files for DoAll Contour Machines

THE EXACT SIZE FOR YOUR JOB
All Models with Meters

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HARDINGE Second Operation Machines
mean
Extreme Accuracy, High Spindle Speeds and Ease of Operation

Extreme accuracy, high spindle speeds and ease of operation have multiplied many times the importance of Hardinge High Speed Precision Second Operation Machines.

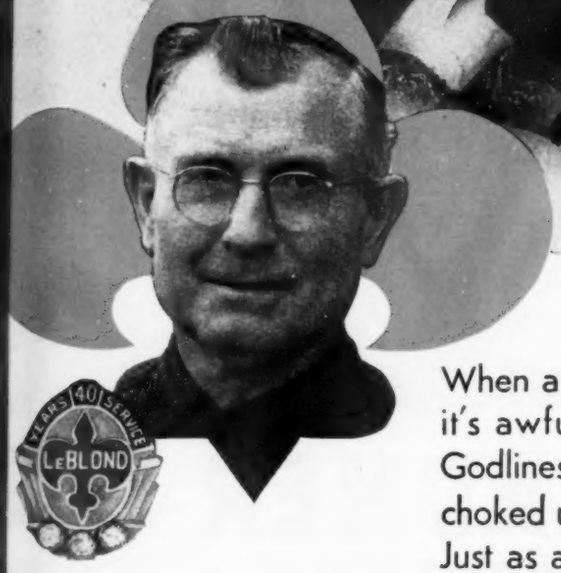
This combination means greater accuracy and better finish under the close tolerances of manufacturing standards both today and in the days to come. The ease and simplicity of operation enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling.

CAPACITY:
1/16" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds: 230 to 3900 R.P.M.

"Performance has established leadership for **HARDINGE**"

HARDINGE

HARDINGE BROTHERS INC., ELMIRA, N.Y., U.S.A.

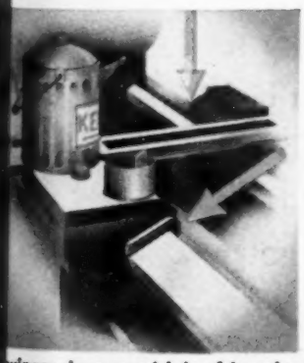


"I'm Tellin' You . . ."

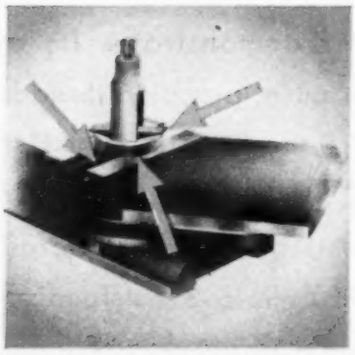
(No. 3 in a series of tips on "Keeping 'em Turning")

by **John Gauche—40 years with LeBlond**

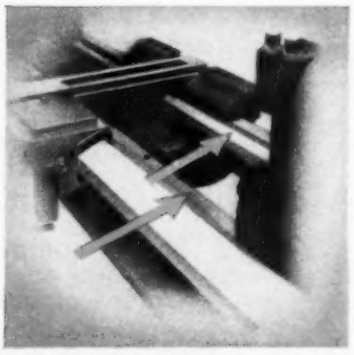
When a lathe hand gets absorbed in turning out a piece of work, it's awfully easy for him to forget that Cleanliness is next to Godliness. But if he does forget, and allows his machine to get choked up with chips and turnings–look out, brother, that's trouble! Just as a reminder, I'd like to point out the spots that need close watching to keep your lathe running accurately and smoothly.



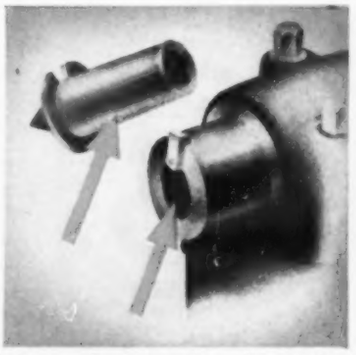
wipers do a good job of keeping nary turnings out from under the ioge. But when you work with iron, you should remove the rs occasionally and clean them in sene to rinse out the dust and grit.



When you place a tool in the tool post, check to be sure there are no turnings between the collar and the compound rest, or between the wedge and the collar. Your tool can't get a firm rest in a dirty tool post.



Don't move the tailstock along the ways without first carefully wiping off all chips. Turnings on the ways will throw the tailstock out of alignment and ruin your accuracy. Also keep tailstock spindle clean.



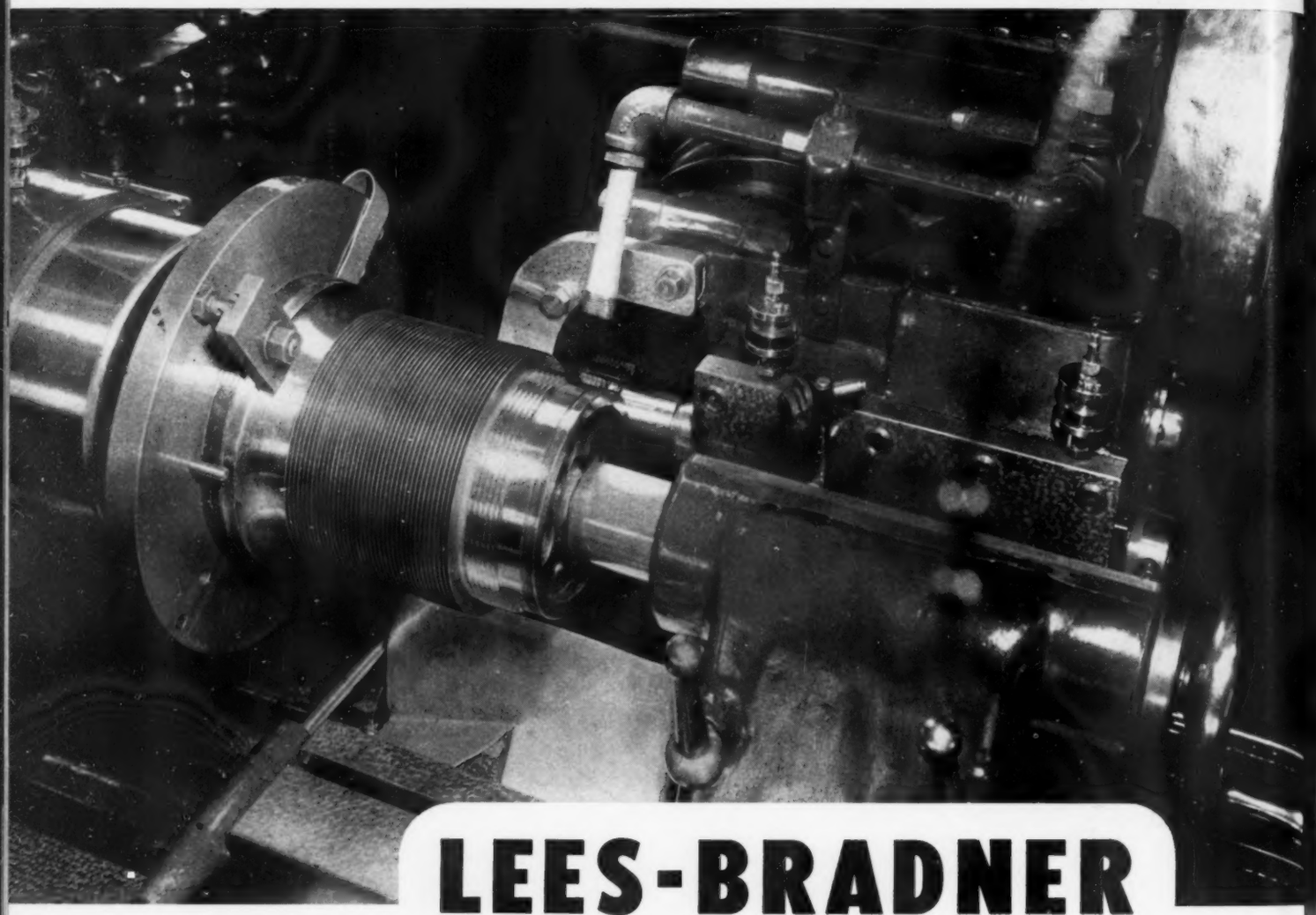
Before replacing center, wipe out the hole and clean the tapered part of the center. When using drills, chucks, or reamers be sure they are tight in the taper hole. If there is dirt between the two, the part will revolve and cut the taper hole.

HE R. K. LeBLOND MACHINE TOOL COMPANY

Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathes

FINE PITCH • PRECISION THREADS • *Faster*



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• THREAD MILLERS •

Again Lees-Bradner demonstrates its ability to produce difficult, fine pitch, precision threads at high production rates. Here the Lees-Bradner H. T. Thread Miller is generating extremely accurate threads on one of the components of a radial aircraft engine in the plant of one of America's outstanding builders of airplane motors at a production rate far greater than previous methods. It will do the same for you.

The LEES-BRADNER *Company*

CLEVELAND, OHIO, U.S.A.

LISTED BY UNDERWRITERS' LABORATORIES, INC.

a motor for use in ...

MAGNESIUM DUST

Also ALUMINUM and other combustible metal dusts

HERE'S a motor specifically approved for service in the presence of magnesium dust (the metal of which incendiaries are made), as well as in aluminum powder and other combustible metal dusts. It fills a critical need of metal-working and ordnance plants, wherever combustible metals are being handled in powder form, and where machining, grinding, or polishing operations are being performed. It's another FIRST among G-E motors for hazardous locations.

Tests of this new totally enclosed motor at Underwriters' Laboratories, Inc., have demonstrated its ability to meet hazards included in Class II, Group E, of the National Electrical Code. For full information, write Motor Division, General Electric, Schenectady, N. Y.

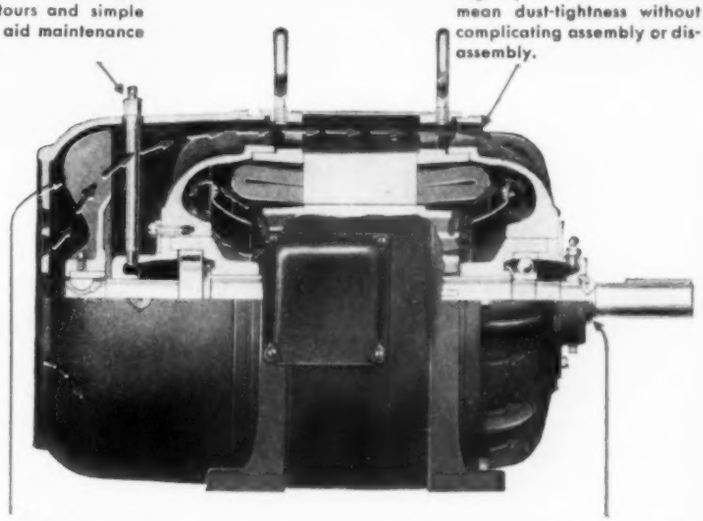
METAL DUST . . . ACETONE . . . TOLUOL . . . GASOLINE . . . COAL DUST . . . GRAIN DUST . . . Name your hazard—this family can meet it.

No single enclosed or explosion-proof motor is recommended for all types of hazardous service. General Electric has pioneered in producing a family of motors to meet the dangers of specific gases, vapors, liquids, and dusts. Our engineering staff can help you pick the right motor, and advise on the use of overload relays and other installation factors for full-scale protection.

Typical Class II, Group E, motor now available in sizes up to 125 hp

Pressure-relief lubrication, smooth contours and simple construction aid maintenance

Tight joints, accurate fits mean dust-tightness without complicating assembly or disassembly.



Effective cooling is obtained even under a blanket of dust

Labyrinth seal and complete cast-iron bearing enclosure exclude dust for continuous operation

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

BUILDER OF TRI/CLAD MOTORS

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GENERAL ELECTRIC

750-157-8058

ELECTRIC MOTORS ARE BUILT WITH EXTRA RESERVES OF POWER FOR EMERGENCIES....

use EMERGENCY motor power now!

In peacetime, motors are applied with a substantial reserve safety factor. In other words, most applications are "overmotored" . . . the motors are capable of producing more horsepower than is required by the machines they drive.

Such "overmotoring" provides a reserve to take care of unexpectedly heavy loads, and assures long life with low maintenance cost.

But today, our problem is to "make the most of what we've got"—to get more production out of each and every motor.

Recognizing this fact, Westinghouse, at the suggestion of the War Production Board, now recommends that motor users modify their peacetime practices . . . that they get the most out of every motor they have . . . that in applying new motors or relocating old ones, they take advantage of all possible favorable operating conditions . . . that they load each motor to the limit.

A summary of these recommendations is presented in the booklet "Calling All Horsepower," illustrated above. Ask today for your free copy. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-21250

Westinghouse

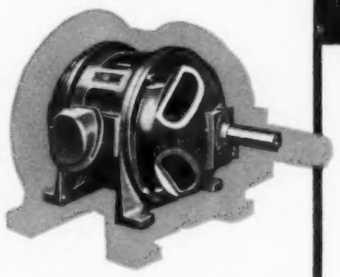
THE WESTINGHOUSE "CALLING ALL HORSEPOWER" PROGRAM IS DESIGNED TO:

- **Get maximum production out of every motor.**
- **Save critical materials.**

The program has as its basis close teamwork between industry and Westinghouse engineers, aimed at determining with maximum accuracy the exact horsepower required by the driven machine.

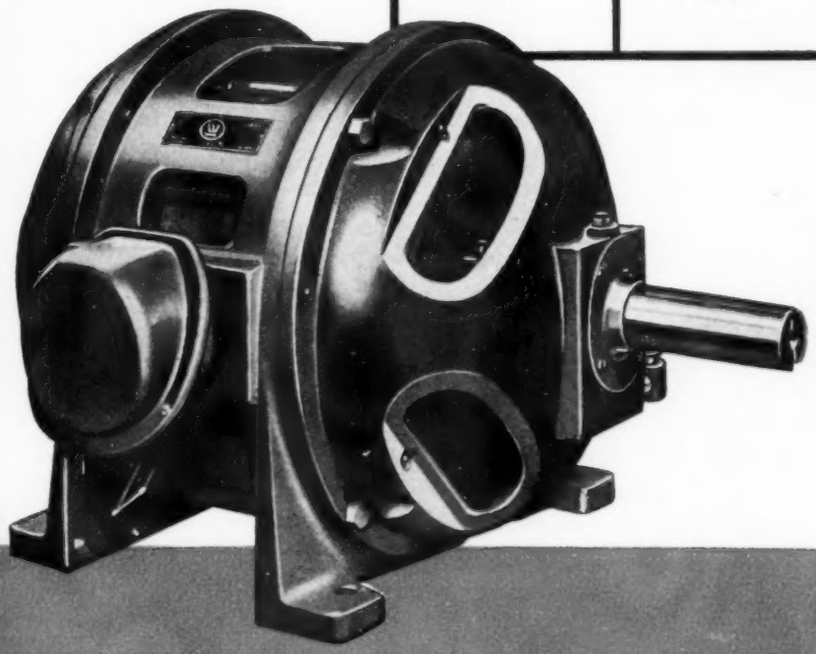
In keeping with these findings, it then offers specific recommendations which will enable users to take advantage of (1) all favorable operating conditions; (2) extra service factors built into Westinghouse motors. Some typical results possible with this program are shown in the table below.

OPEN TYPE A. C. MOTORS



40°C rated, in applications seldom reaching or exceeding this temperature.

for THIS LOAD	*use* THIS RATING	*instead of* THIS RATING	*save these* MATERIALS
hp	hp	hp	lbs.
1.25	1.	1.5	36
1.88	1.5	2.	14
3.75	3.	5.	19
6.25	5.	7.5	63
9.38	7.5	10.	80
25.0	20.	25.	106
37.5	30.	40.	186
62.5	50.	60.	320
125.	100.	125.	550



STANDARD WESTINGHOUSE MOTORS ARE GENERALLY AVAILABLE FOR PROMPT DELIVERY FOR WAR JOBS

Motors and Control

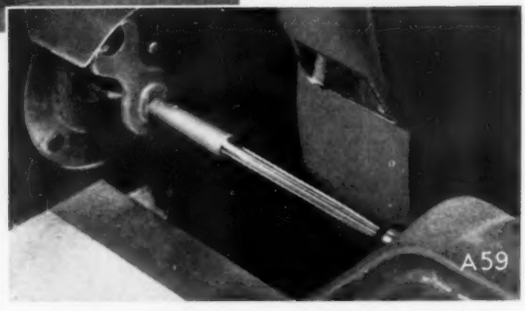
WESTINGHOUSE

TO FINISH THE JOB QUICKER

PRECISION LANDIS GRINDERS

Unusual Performance As Usual

Grinding taper bridge reamers **on several Landis 4" x 18" Type H Plain Hydraulics.**



A REAMER MANUFACTURER GOES "LANDIS 4" TYPE-H"

Another small tool manufacturer is discovering the production advantages of the Landis 4" Type H Plain Hydraulic Grinder. This time it is the Wayne Tool Company, well-known reamer specialists.

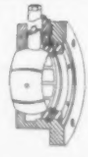
One of the first reasons for this user's satisfaction is the fact that these Landis 4" Type H Plain Hydraulic Grinders may be switched over from straight infeed to traverse grinding or vice versa in an instant simply by the turning of a knob. In the handling of a wide variety of sizes and types of reamers, Wayne has found this to be a particularly attractive feature. Heretofore basically high production grinders did not give them such versatility nor such ease of handling either.

The hydraulically operated footstock spindle with foot pedal control is another contributing factor to this user's satisfaction. Operators like it because it frees one hand. Both machines are equipped with a hydraulic timer which steps up the production of work in larger lots.

No small tool manufacturer can afford to overlook the productiveness of the Landis 4" Type H in these days when his output is needed so quickly and in such quantity.

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.

VARIABLE VOLTAGE HEADSTOCK.



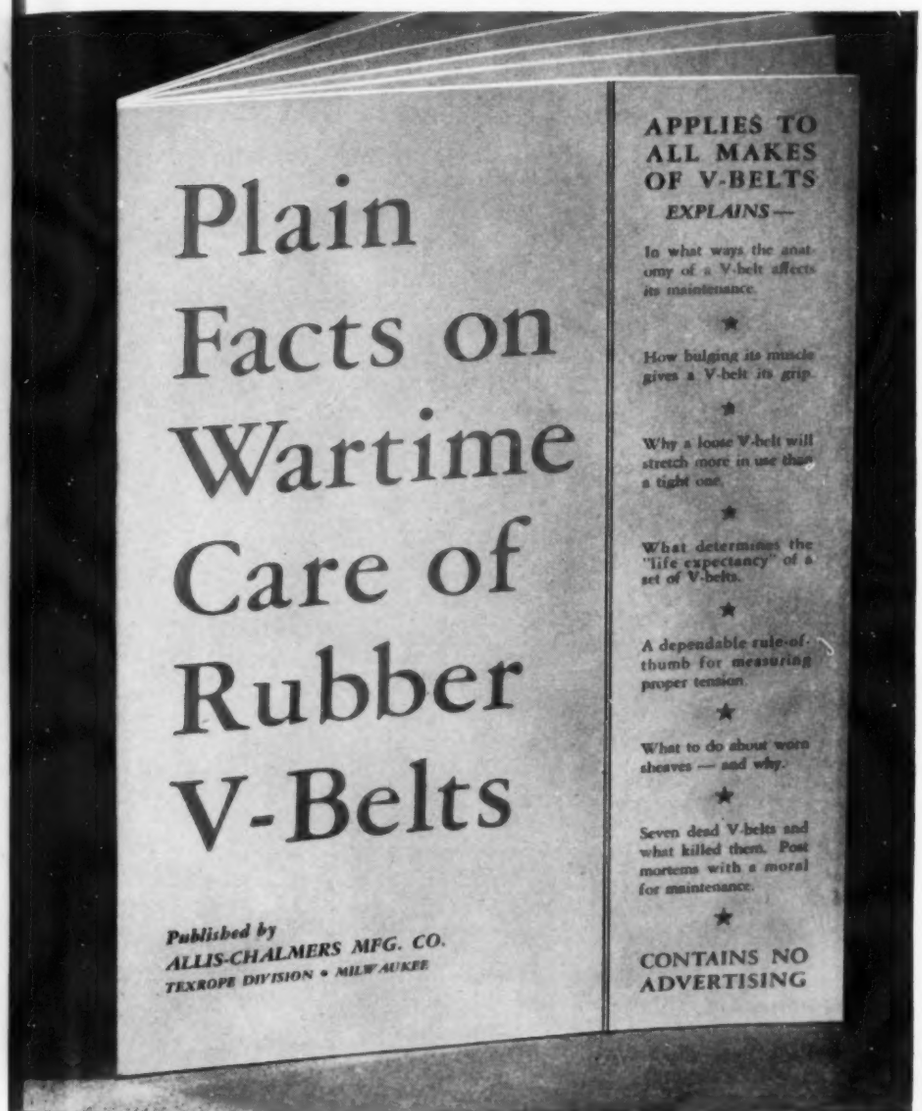
MICROSPHERE WHEEL SPINDLE BEARINGS.

MICROMETER WHEEL FEED.

399

ANNOUNCING ALLIS-CHALMERS' NEW

Wartime Guide to V-belt Care!


Plain Facts on Wartime Care of Rubber V-Belts
Published by
ALLIS-CHALMERS MFG. CO.
TEXROPE DIVISION • MILWAUKEE
APPLIES TO ALL MAKES OF V-BELTS
EXPLAINS—
In what ways the anatomy of a V-belt affects its maintenance.
★
How bulging its muscle gives a V-belt its grip.
★
Why a loose V-belt will stretch more in use than a tight one.
★
What determines the "life expectancy" of a set of V-belts.
★
A dependable rule-of-thumb for measuring proper tension.
★
What to do about worn sheaves — and why.
★
Seven dead V-belts and what killed them. Post mortems with a moral for maintenance.
★
CONTAINS NO ADVERTISING

It's free to every engineer, executive and maintenance man now concerned with raising V-belt performance to new wartime standards of efficiency. Rubber V-belts are a precious national asset! And here's the full, interesting story on how to make them work better, last longer than ever before. Send to Allis-Chalmers for this valuable new handbook today!

[PRINCIPLE OF THE V-BELT DRIVE]
Like Bending an Arm
...Bending a V-Belt
Bulges its Muscle!
HOW BULGING TENDENCY GIVES V-BELTS THEIR GRIP

FULLY ILLUSTRATED—It's packed with practical data... specially designed for training new men!

V-Day needs every V-Belt

FREE! Every engineer should have this important new handbook in his technical library. It applies to *all* makes of V-belts... contains no advertising. Tear out the order form and send it in *now!*

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive a *free* copy of "Plain Facts on Wartime Care of Rubber V-belts."

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Title: _____

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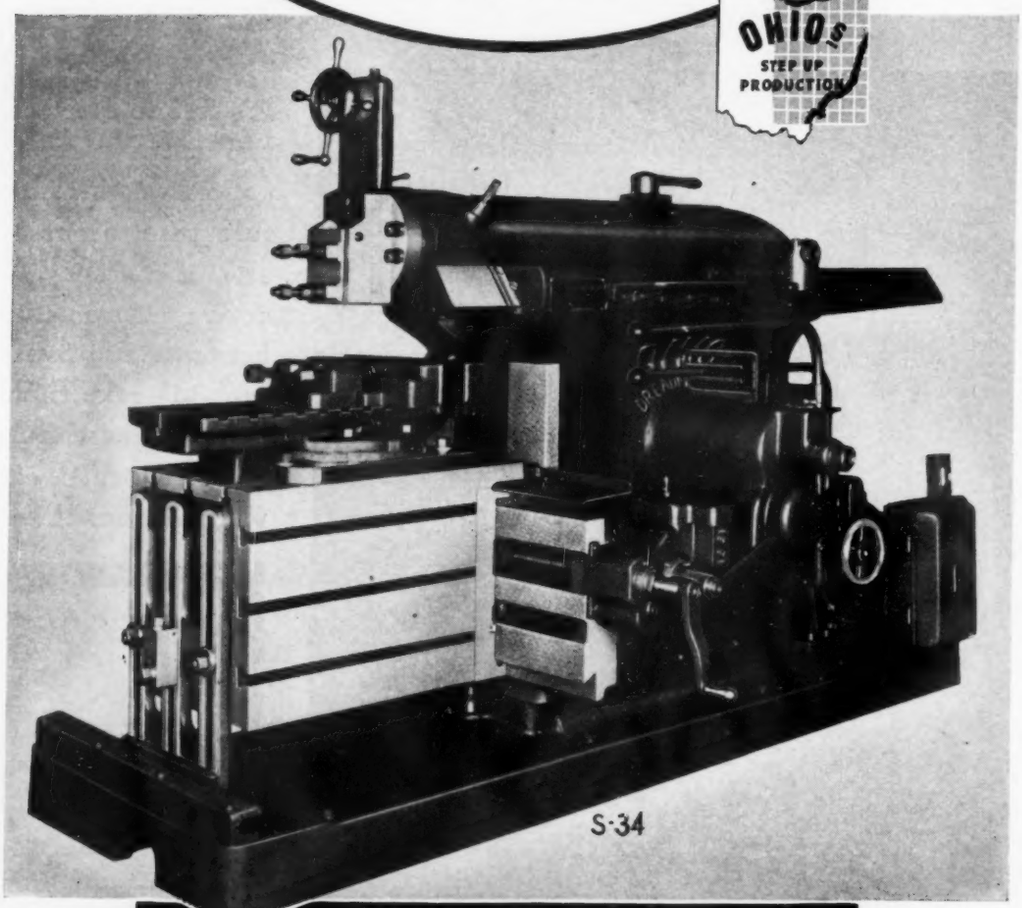
WE WORK FOR VICTORY — WE PLAN FOR PEACE

TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

OHIO DREADNAUGHT SHAPERS

OHIO'S STEP UP PRODUCTION



Ohio Dreadnaught Shapers answer the call for top production with ample power, heavy duty construction and reserve capacity, which enable them to machine bigger and bigger parts and more and more of them . . . One-position control makes operation easy. Inbuilt rigidity and accuracy promote fast, accurate work . . . Many accessories and attachments meet specific requirements.

THE OHIO MACHINE TOOL COMPANY
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OHIO DREADNAUGHT
HORIZONTAL BORING, DRILLING AND MILLING MACHINES • SHAPERS • PLANERS

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FASTRAVERSE PRESSES COLD NOSE STEEL ARTILLERY SHELLS

HPM shell nosing presses are one of many types of HPM self-contained hydraulic presses producing large quantities of ammunition for America's BIG GUNS. ● Included in the HPM munition press line-up are shell forging, nosing and testing presses; cartridge case cupping, drawing, tapering and heading presses; projectile loading presses. ● Other HPM metal working and process presses are producing airplanes, tanks, guns and other war material necessary for final victory. » » »

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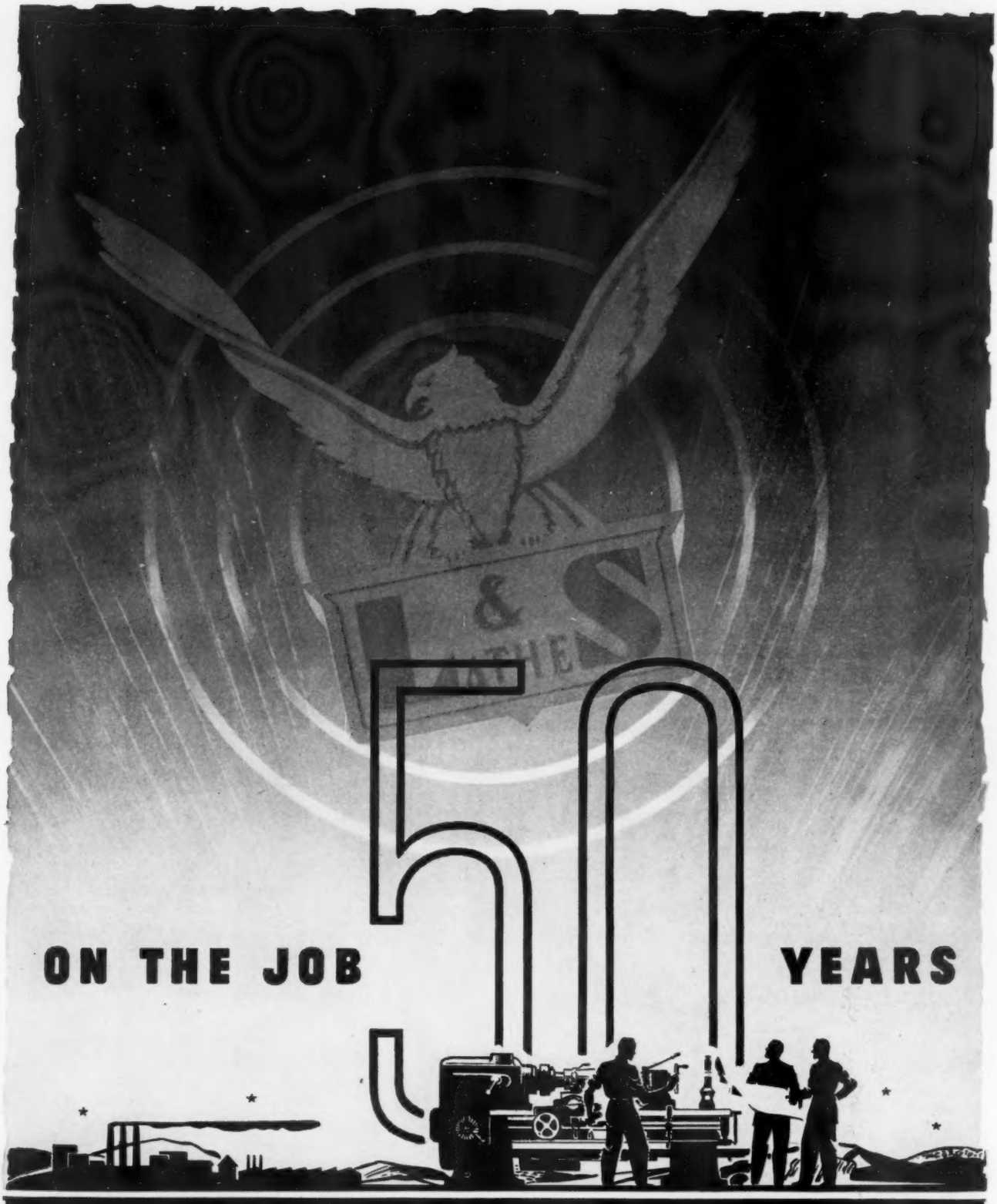
District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities



Lathes, Good Lathes Only

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

ENGINE TOOL ROOM AUTOMATIC LATHES

Award to Accuracy

ARMY E NAVY

AUGUST 20, 1942

Standing: C. R. Burt; seated: Col. E. A. Deeds; Lt. Gen. Wm. S. Knudsen; Gov. Robert A. Hurley.

"This is to inform you that the Army and Navy are conferring upon your organization the Production Award for high achievement . . . The high and practical patriotism of the men and women of Niles-Bement-Pond Company is inspiring and heartening. Their record will be difficult to surpass."

Robert P. Patterson
Under Secretary of War

(from a letter to Pratt & Whitney, July 27, 1942)

"Pratt & Whitney's part in this war began long before Pearl Harbor, for it has been our job to supply basic tools — the machines that make machines — to the war plants of the United Nations . . . to prepare them for the all-out production drive which has followed. Our effort has been constant, sincere, relentless. We are gratified to have this effort recognized with the award of the Army-Navy 'E.' Yet each of us knows in his heart that we can and must do better still. Our work has only begun. We must turn out more and ever more of the tools that will build unconquerable strength for our fighting forces. *And we will.*"

(From an address by Clayton R. Burt, President, Pratt & Whitney, upon receiving the Production Award, August 20, 1942.)

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ **Production**

Adaptability

★ **Fixture Saving**

Operation Saving

Material Saving

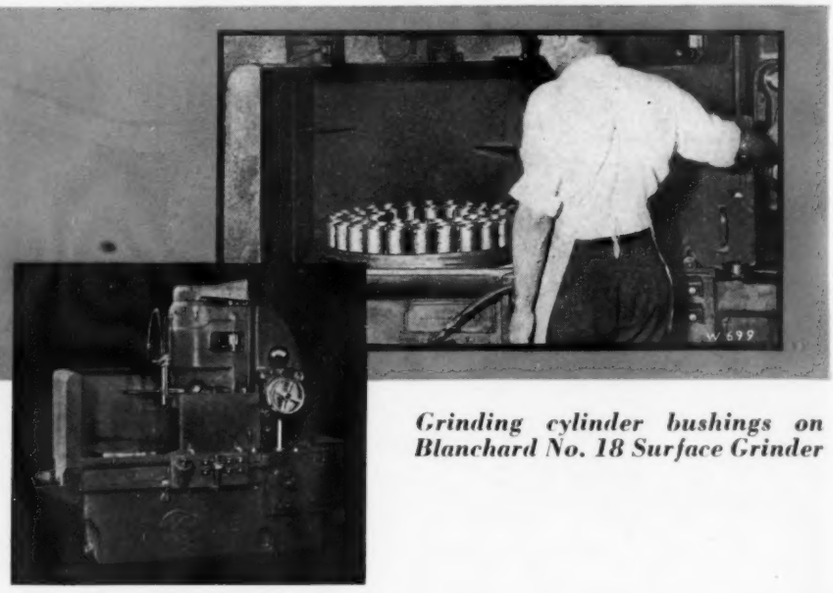
Fine Finish

Flatness

★ **Close Limits**

★

. . . . . *Especially valuable on jobs like the one illustrated.*



Grinding cylinder bushings on Blanchard No. 18 Surface Grinder

THESE cylinder bushings, 3½ inches high by 3½ inches in diameter, are of extremely thin section, yet they are held securely on the Blanchard No. 18 magnetic chuck. These bushings are Gunite castings. .006″ of stock is ground off both ends to limits of ±.0005″ for size, and .0005″ for parallelism. 50 pieces (100 surfaces) are ground per hour.

Multiple chucking and grinding on the Blanchard is the sure and economical way to machine parallel surfaces on parts such as these, also on collars, gear blanks, and washers.

The Blanchard Magnetic Chuck is so adaptable to holding a wide variety of work that it takes the place of many expensive fixtures that would be necessary on other types of machines.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

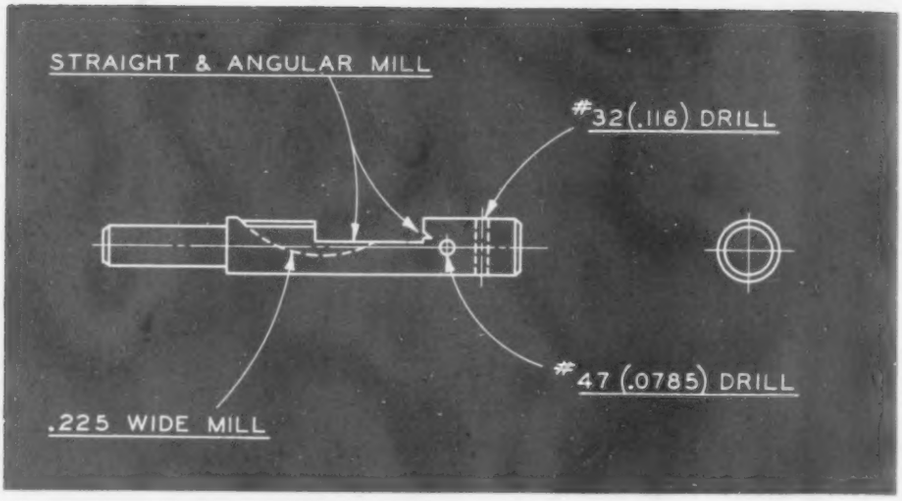
REMEMBER, SON, FINE TOOLS DESERVE PROPER CARE !

Keep Your Turret Lathes Properly Leveled

Lubricate Your Machine at the Start of Each Shift

GISHOLT

★ *Reprints of this page are available free for bulletin board use in your turret lathe department. Write the Gisholt Machine Company, 1201 East Washington Avenue, Madison, Wisconsin. Ask for "Care and Operation Poster No. 1." State quantity desired.*



THIS IS A

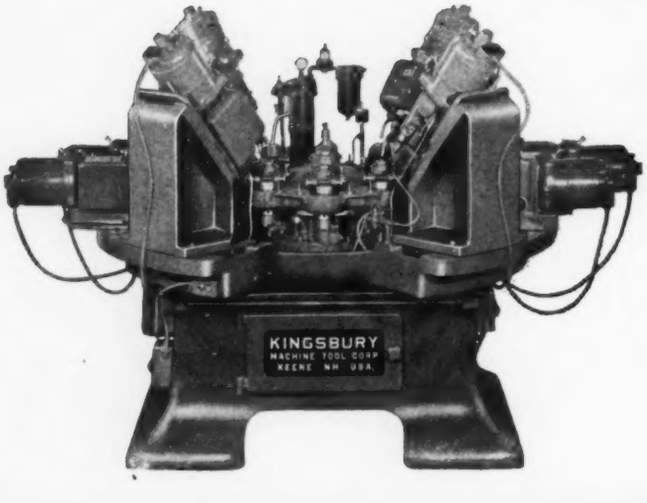
FLEXIMATIC

SMALL ARMSJOB!

Turning out rifle bolts to exact specifications under a fast production schedule

FLEXIMATIC

by KINGSBURY



Many vital needs of armament production are being met with FLEXIMATICS—the machines which perform a wide variety of machining operations in a single chucking of the work.

The Model GD FLEXIMATIC shown here performs various drilling and milling operations on rifle bolts —a job that calls for the highest in both precision and production.

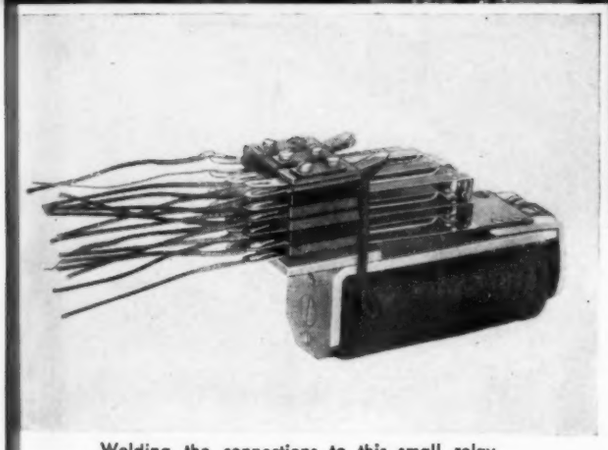
Contributing to the accuracy of the operations performed on this FLEXIMATIC is the mounting of milling spindles on Timken precision bearings. Further safeguarding of accuracy is achieved through driving each spindle by a cone worm and worm gear and dampening vibration by means of a heavy flywheel.

FLEXIMATICS are ideal for all classes of armament production where high accuracy and fast production with unskilled labor are every day conditions which must be met. FLEXIMATICS can, therefore, be depended on to make outstanding production contributions to National Defense.

Write today for illustrated Bulletin showing a number of different set-ups.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U. S. A.



Welding the connections to this small relay was made possible by G-E thyratron control.

...instead of SOLDERING, consider RESISTANCE WELDING

WITH tin and time at a premium, many manufacturers who formerly used soldering now use resistance welding, equipped with G-E thyratron control. It cuts assembly time in half; it entirely eliminates the need for tin.

Solid or stranded control wires and small parts made of copper, brass, bronze, or ferrous alloys require precision-controlled welding. With G-E thyratron controls, such material can be quickly and *permanently* welded at high speed. For this purpose, General Electric has a complete line of thyratron controls designed by outstanding electronic engineers.

The nearest G-E office will be glad to help you in specifying which type of control will best fit your work. Call or write for copies of Bulletins GEA-3045A and 2791C. *General Electric, Schenectady, N. Y.*

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment

GENERAL ELECTRIC

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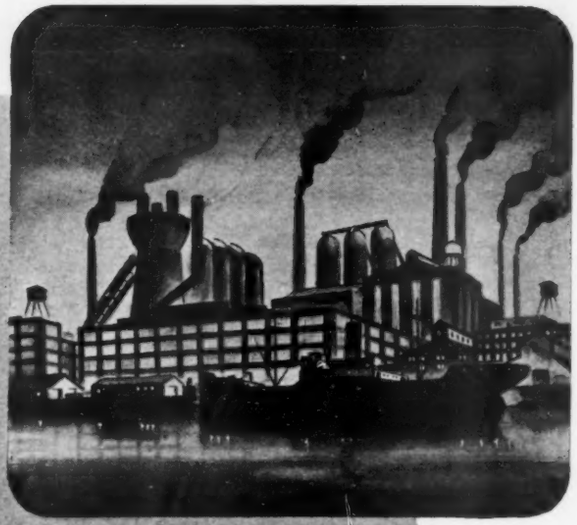
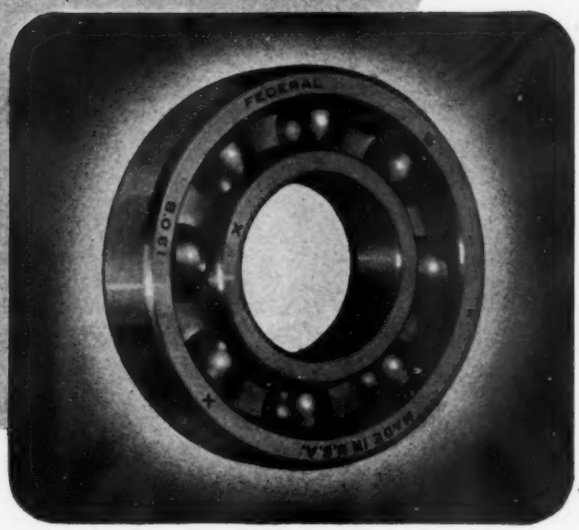
QUALITY

TRADE MARK





FEDERAL
BEARINGS

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

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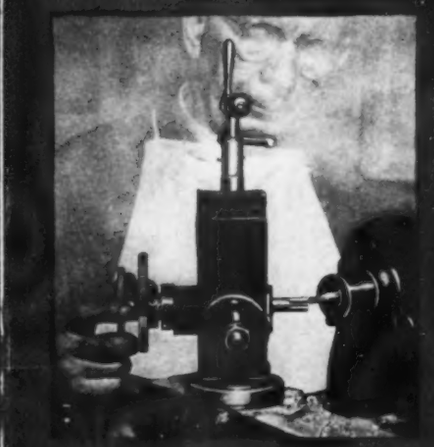

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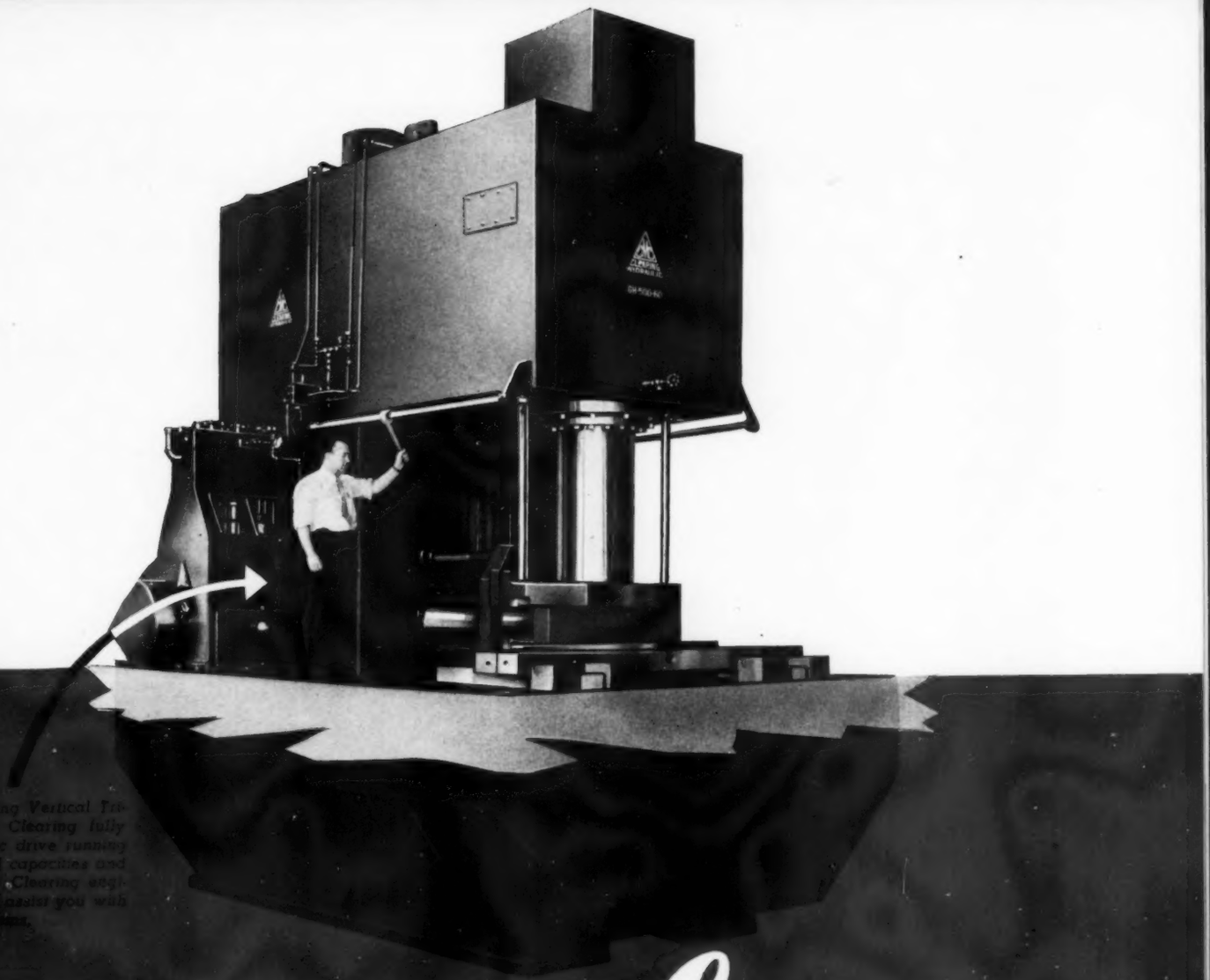

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Simmons did not wait for new equipment before getting squarely behind the Defense Program, Lend-Lease and America's own War Effort. Its employees never worried about the age of a machine tool or whether a textbook editor would consider it "obsolete."

With machine tools ninety-nine per cent of which had been in use for ten years or more, they have been helping to supply the American Arsenal by rebuilding all types of metal-working equipment and building new lathes, boring mills and planers.

This recognition of their efforts in the award of the Battle Flag of Production is an incentive to all Simmons employees to continue to "Keep 'Em Running!"

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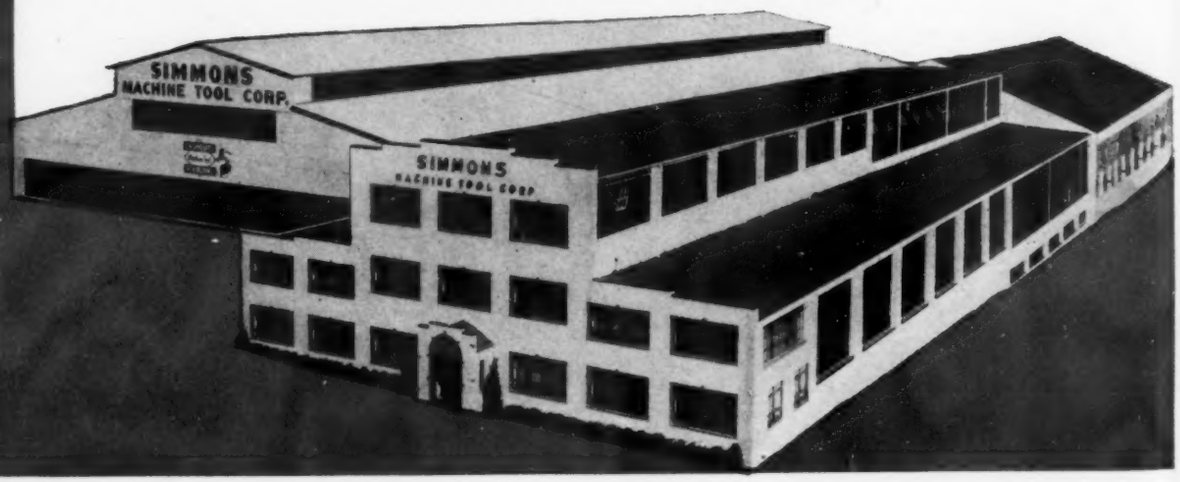

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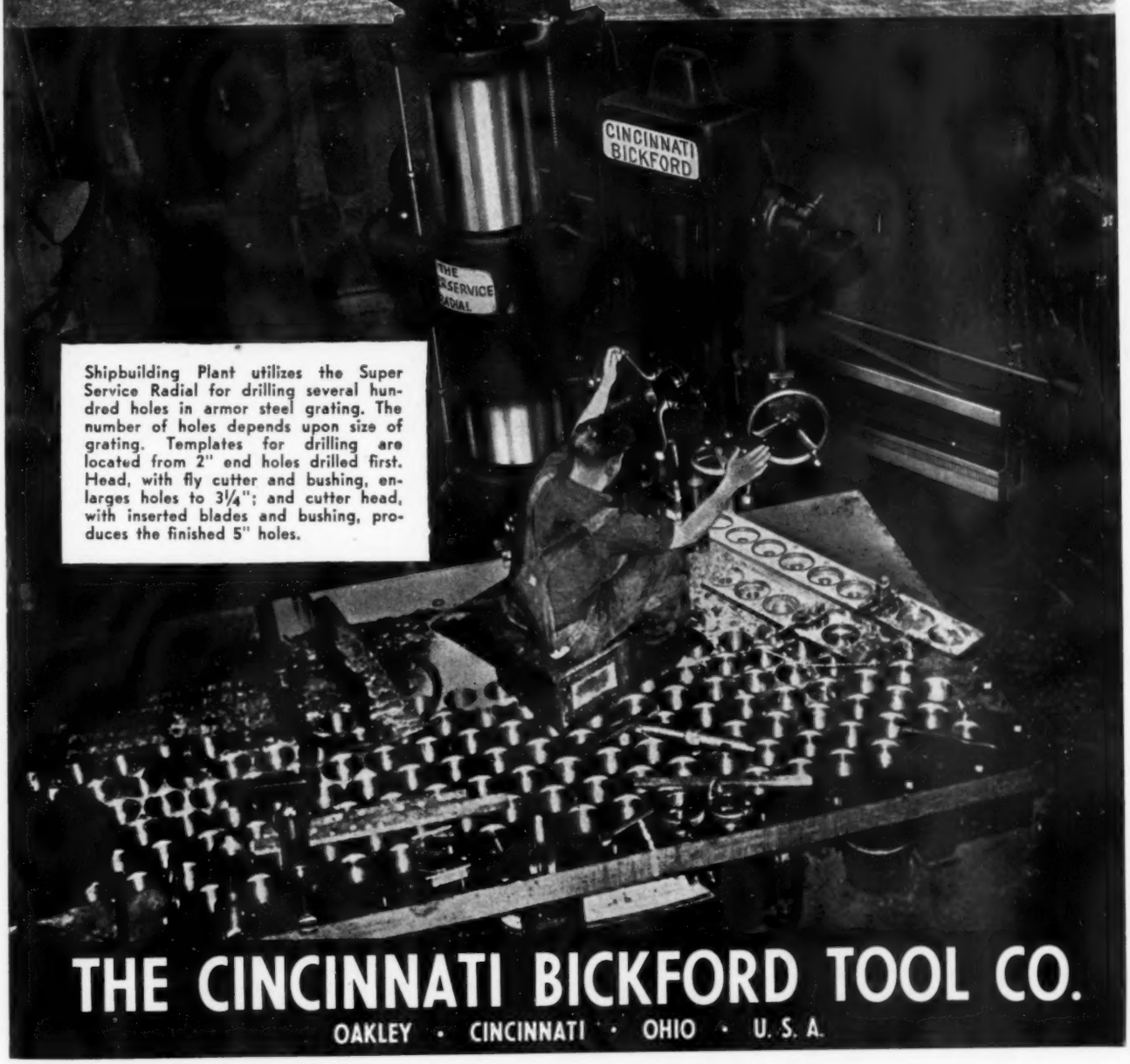

Shipbuilding Plant utilizes the Super Service Radial for drilling several hundred holes in armor steel grating. The number of holes depends upon size of grating. Templates for drilling are located from 2" end holes drilled first. Head, with fly cutter and bushing, enlarges holes to 3¼"; and cutter head, with inserted blades and bushing, produces the finished 5" holes.

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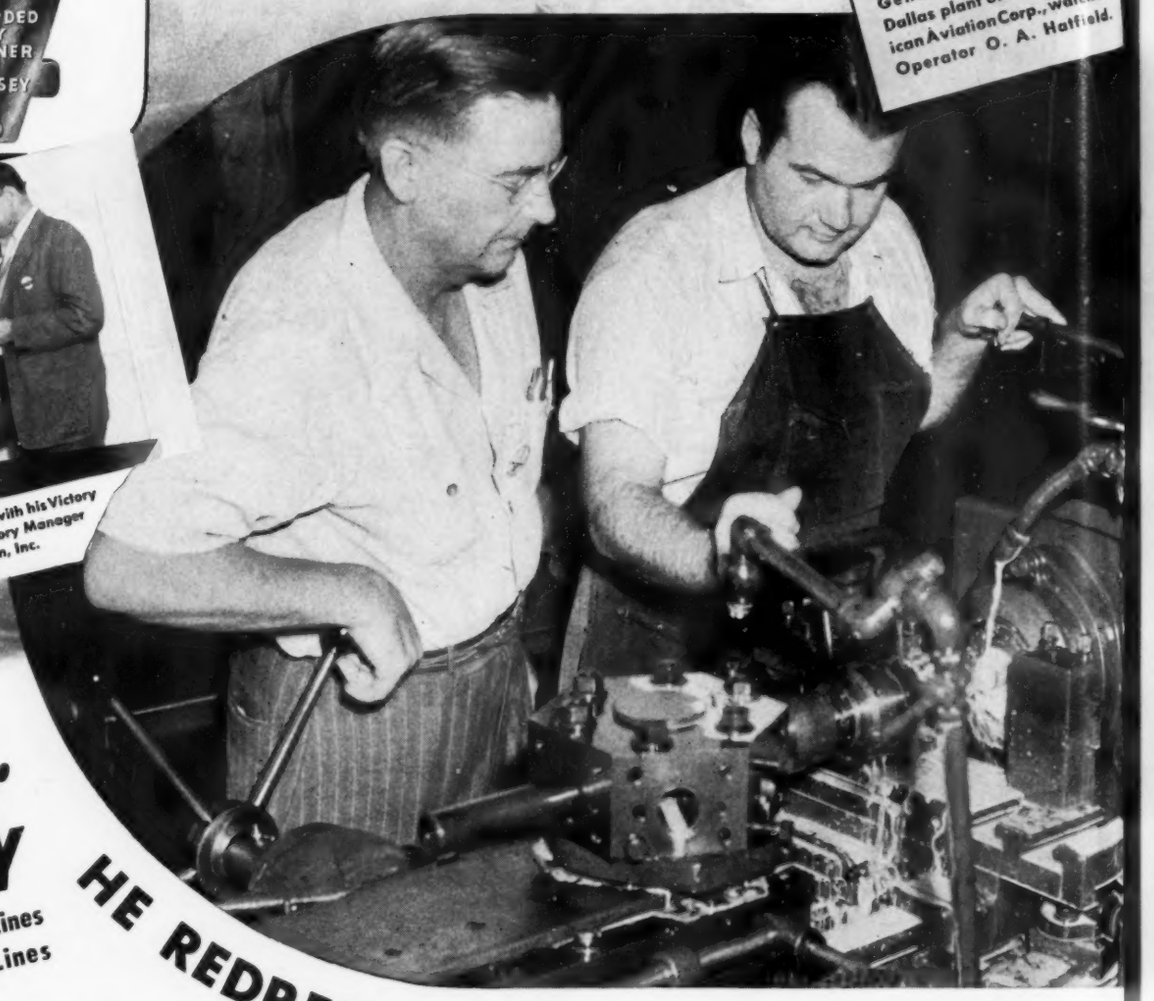
A Citation for Men in War Industry

Paul Rhinehart is presented with his Victory Pin by H. F. Schwedes, Factory Manager of North American Aviation, Inc.



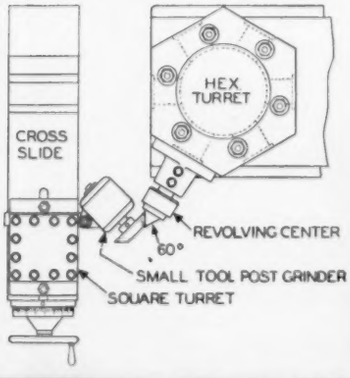
Paul K. Rhinehart, Assistant General Foreman in the Dallas plant of North American Aviation Corp., watches Operator O. A. Hatfield.

Ideas for VICTORY

—from the Production Lines behind the Firing Lines

HE REDRESSES LIVE CENTERS RIGHT ON THE TURRET LATHE

To true up a live center in a turret lathe, a small tool post grinder is mounted in the square turret. By indexing the hex turret one station and feeding the cross slide, the correct angle of 60° is ground. The center is turned by hand.



Paul Rhinehart has contributed many practical ideas to "Blue Chips," the Warner & Swasey shop bulletin that goes to over 30,000 turret lathe operators. He now is supervisor of a battery of turret lathes at the Dallas plant of North American Aviation Corp.

Some of the work requires a revolving center to support the piece under heavy cuts or light cuts run at high speed. Although hardened and ground, the center sometimes becomes worn. The diagram at the left shows Mr. Rhinehart's method for redressing centers right on the turret

Hundreds of good suggestions come to Warner & Swasey, showing how resourceful operators are using their skill and ingenuity to increase production. A gold "Victory Pin" is sent to these men, and many of their ideas are passed along to other operators in "Blue Chips" which is sent free to the homes of turret lathe operators. Make sure your operators—old-timers and learners—are on our list to get it regularly. Write Warner & Swasey, Cleveland, Ohio.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS, WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

ALLAN H. CANDEE

D. M. PATTISON

CHARLES B. STANTON

FRED W. LUCHT

CANDEE ON GEARS

A great many people cut gears today who formerly left this job to specialists. There is no question that gears are different from the average run of shop work and that they can cause headaches if not properly understood. A. H. Candee, the Gleason Works, gives a helpful review of the subject which tells of the various types of gears and methods of cutting them. Page 1006.

PLANT POLICE

In the days before Pearl Harbor, the manufacturing plant was often protected at night by a pensioner who acted as a watchman. Such precautions are not adequate today. Most plants have a full grown police force of young vigorous men, specially trained in their job of apprehending the saboteur. A. A. Agostini, safety supervisor, Kearny & Trecker Corporation, tells how to organize such a force. Page 1018.

MORE ON CITY GAS

Readers interested in the series on flame hardening, by R. F. Apter and Harry W. Smith, Jr., the Selas Company, will want to read the current installment on the use of semi-automatic equipment. These articles deal solely with city gas hardening. Page 1012.

TOOLS FOR CONVERSION

Change-over from peacetime to wartime production can often be done by the smart application of standard tools and attachments to old equipment. Such action makes machines available at once and avoids special engineering and tool-making. D. M. Pattison, the Warner & Swasey Company, gives a number of timely examples. Page 1003.

TRAINING INSPECTORS

Stepped up schedules in ordnance manufacture have created a shortage of trained inspectors, a condition now being corrected by training programs in technical colleges. Carnegie Tech has such a course and by means of certain innovations has substantially shortened its duration. The program is ably described by Maj. Charles B. Stanton, its administrator. Page 1015.

WHEEL MARKINGS AND BEND RADII

Reference Book Sheets in this issue have special significance. One of them introduces an industry-wide standard on grinding wheel markings which should dispel much of the confusion caused by a separate system for each manufacturer. The other sheet tells of the minimum permissible bend radii found practical by the Vega Aircraft Company. Tables compiled by Vega engineers cover a variety of materials. Pages 1039 and 1041.

FUZE MAKERS GET TOGETHER

Manufacturers of mechanical time fuzes have boosted their output by a coordinating committee. The result has been a virtual pooling of facilities in which the entire group acts as a unit, avoids overlap and interchanges production ideas. Burnham Finney tells how this plan put production a year ahead of schedule. Page 1001.

ARMOR PLATE

Not much has appeared in print on armor plate because many of the facts regarding its heat-treatment and composition are confidential. However, something can be said on the subject of machining. Fred W. Lucht, engineer, the Carboloy Company, describes the tooling needed for cast armor plate in this issue.

DIE CASTING INSERT

One advantage of die castings is that inserts of other materials can be cast into them in order to get increased wear or other physical characteristics at special points. Often the use of inserts simplifies machining. A spread of practical applications collected by Herbert Chase appears in this issue. Page 1010.

COMING

War economy has dictated the use of new metals. The new National Emergency steels are just one example of changes in materials made expedient by shortages in certain alloying elements.

For this reason the coming national Metal Congress and Exposition is particularly timely. New metals mean new methods and new equipment.

Our next number will be our National Metal Show Number which gives a preview of the Exposition and in addition a wealth of exclusive data on metals and their working. A special blue-paper section will be devoted to the "Working of National Emergency Steels."

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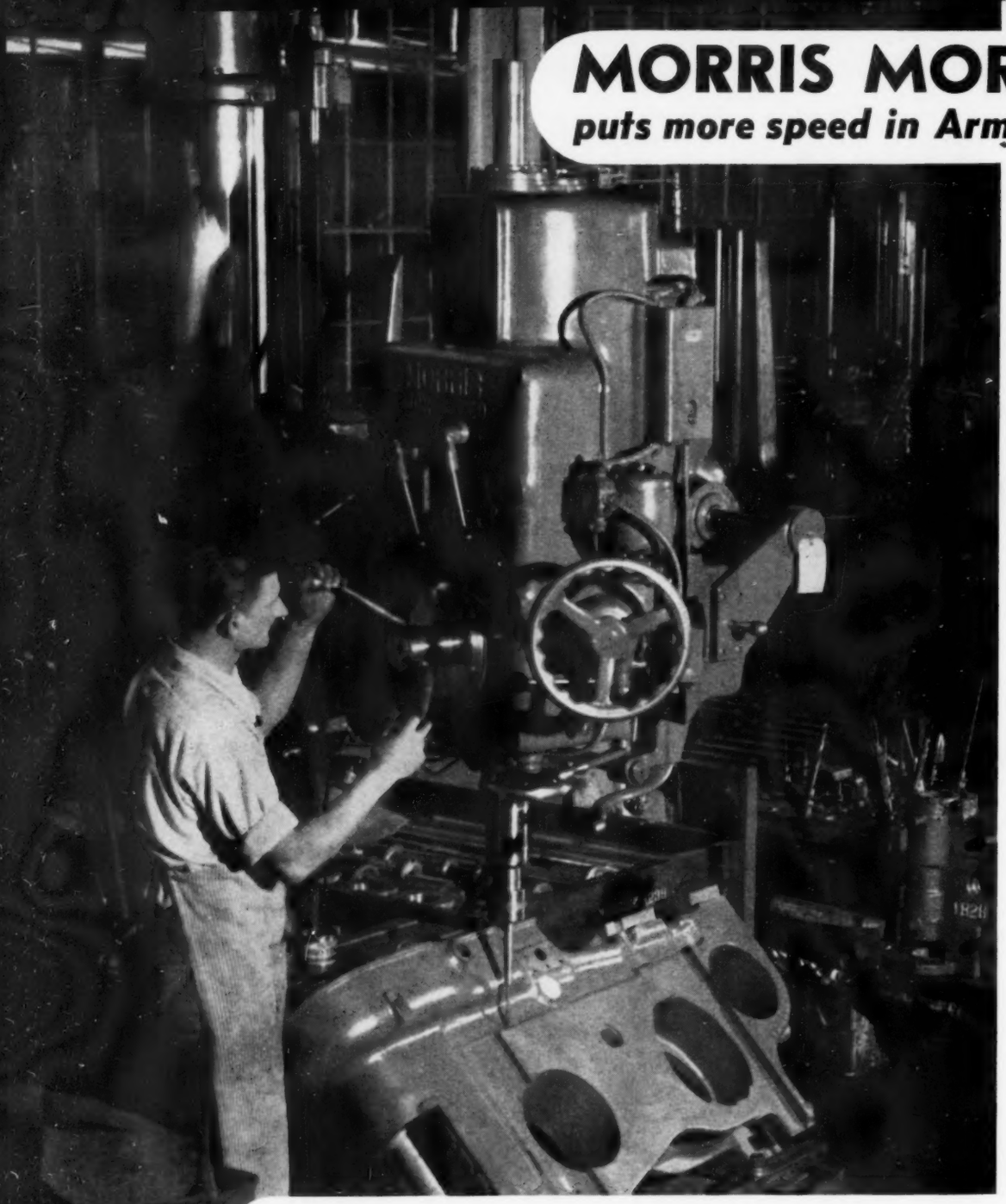
puts more speed in Arms Production



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Fuze Makers Speed Output By New Kind of Cooperation

BY BURNHAM FINNEY, EDITOR, AMERICAN MACHINIST

Producers of other war items can profitably adopt plan of reaching full production with minimum of plant facilities

A NEW KIND of industry cooperation is bringing sensationally successful results in speeding the war production effort!

It already has saved an entire year in achieving maximum production of mechanical time fuzes, one of the critical and important ordnance items which requires unusual precision in manufacture. Originally the top monthly schedule for this item was to be reached the middle of 1943. And two completely new factories were to be erected and equipped to help attain that goal.

Instead the goal was reached in the summer of 1942—and it was not necessary to construct the new plants. That meant a substantial saving in building materials, in machine tools and other plant equipment, and in labor.

The plan of industry cooperation was conceived by Major General Levin H. Campbell, Jr., Chief of Ordnance of the United States Army. It was first tried out among companies producing mechanical time fuzes. Its successful application there has led to its extension to a number of other items manufactured for the Ordnance Department.

In brief, the plan has many advantages: (1) it obtains full production of ordnance items with a minimum of plant facilities, using existing capacity to full extent rather than relying upon creation of new plants; (2) it makes available the knowledge and skill of the larger manufacturer to the smaller company or the newcomer, bringing the latter into maximum production in the shortest possible time; and (3) it discloses to the Ordnance Department on quick notice complete information regarding the productive capacity of an industry, its inventory of parts and materials, and its total resources.

Rapid Changes Feasible

There is still another benefit. The close cooperation among the industry members makes feasible rapid changes in production rates to meet the exact and varying requirements of the military services.

The plan consists of the establishment of so-called "industry integration committees." Such committees are comprised of representatives of all manufacturers engaged in making a single ordnance item, such as mechanical time fuzes. The committee, allied with the Ordnance Department on a voluntary basis, functions much as though a corporation had been formed to make the specific product involved.

Representatives on the committee are equivalent to the board of directors. The chairman of the board of this corporation is the Chief of Ordnance, who acts in an ex officio capacity. The chairman of the committee is the chief of the Ordnance Department branch affected. A commissioned officer is deputy chairman.

The assistant chairman, who acts as general manager, is a civilian from the particular industrial group of which the committee is composed. He is in active charge of the group's production. He usually is chosen from the ranks of production men. One or more Ordnance officers are assigned to work with the assistant chairman in carrying out his duties.

Each manufacturer has one representative on the committee. That representative invariably is a man with experience on the production side.

The committee has no authority to commit the Ordnance Department to any action or policy whatsoever. It confines its duties to collecting and correlating information and making recommendations. The main ordnance officer attached to the committee and cooperating with the assistant chairman receives the committee's recommendations. He in turn has the power to carry out the recommendations as an order from the Ordnance Department, provided they are in accordance with Ordnance procedure.

This plan, it should be stressed, has

the blessing of the Department of Justice. The Attorney General does not see in it a conspiracy in restraint of trade or a scheme for creating a monopoly. He has defined the limits within which it may operate freely, those limits being "to obtain maximum production of certain ordnance supplies and material from available facilities." He also specifically states that "contractors' representatives on the committee are limited in their functions to the collection, correlation and analysis of information, and to the making of recommendations."

The success of the plan lies in the extent to which production of an Ordnance item is "integrated." The dictionary defines "integration" as "forming into one whole." The purpose of the industry integration committee for any single product is to have all the manufacturers of that product function as one unit instead of as separate companies.

Production Facilities Listed

Committee members furnish the assistant chairman with a list of production facilities of their own companies, the actual and projected rates of output, the inventory of finished parts, the inventory of material on hand and on order, and promised delivery dates. The committee thereupon recommends the allotment of definite production schedules to each company. These schedules can be adjusted from time to time by the Chief of the Ordnance Branch as the situation of each contractor changes.

Formation of the companies into a unified whole calls for closer cooperation than ever before attempted inside any manufacturing group. The committee goes so far as to recommend to the assistant chairman the interchange among companies of parts, materials, tools and machines. It further suggests an interchange of knowledge and skill.

Interchange of private property of one company with another is by outright sale or on an exchange basis. The exchange of machines or tools which are owned by the government but in the possession of a member company is merely a paper transaction.

Activities of the committee are numerous. The committee is in possession of information about a company's production performance. Based on its records, it can advise the Chief of Ordnance the most economical method of adjusting production to meet the requirements of the armed forces.

The committee's influence goes so far as to permit the making of recommendations of changes in materials specifications and revisions in manufacturing procedure which will facilitate production. The sole qualification is that these recommendations must not affect the efficient functioning or the interchangeability of components or assemblies which go into the ordnance item.

The industry integration committee plan was first put into effect last spring by seven makers of mechanical time fuzes for the Ordance Department: Eclipse Machine Division of Bendix Aviation Corporation, Eastman Kodak Company, National Cash Register Company, Hamilton Watch Company, Elgin National Watch Company, George W. Borg Corporation and the Frankford, Pa., government arsenal. Pulled into the plan as chief subcontractors are four watch makers.

Eclipse Division of Bendix was the first company to go into manufacture of mechanical time fuzes on a large scale. It got a head start on other companies. When the cooperative plan was initiated, this company's store of knowledge and experience was greater than that of anyone else. It logically became the key company in the plan.

Its general manufacturing manager, Roy Hurley, took on the assignment as the assistant chairman in charge of the mechanical time fuze committee. The chairman was Brigadier General Hardy, chief of the ordnance branch under which fuze manufacture came.

Train Each Other's Workers

The cooperation of fuze manufacturing companies in training each other's workers is one of the most amazing bits of evidence showing how the plan works. A scheme practically unheard of was tried out and proved successful.

Eclipse Division of Bendix had two manufacturing lines set up in its factory from which completed fuzes were coming by the thousands. In between these two lines was installed a third line owned and operated by the George W. Borg Corporation, which was just getting started.

The machinery and equipment for this line were Borg's property. The operators were green help furnished by Borg. At stated intervals along this line Eclipse put its own experienced operators to train the Borg operators. Eclipse also provided the inspectors.

It wasn't long before the Borg operators got the feel of the work so that the Eclipse operators could return to their own production line. After a relatively short time, the Borg line was running smoothly enough that the entire set-up, machinery and operators, was moved bodily over one week-end from the Eclipse factory hundreds of miles to the Borg plant and resumed production on Monday morning. The trained Borg operators acted as instructors for new workers and soon hundreds of people were familiar with a delicate manufacturing job.

Months were saved in getting Borg up to its maximum production schedule by following this procedure. The same technique was used by a watch company, which installed a manufacturing line manned by its own untrained operators at the Frankford arsenal, where the trained Frankford personnel taught these new operators their new jobs.

Task Is Not Simple

All of this sounds simple, but it wasn't. To get seven manufacturers to cooperate so closely that they virtually live and work together, especially when those companies have been accustomed through the years to guarding well their secrets from their competitors, is a major achievement. It literally is a fact that in several cases manufacturers never had been inside each other's plants until the industry integration committee plan was established.

All of these companies, from the first, have cooperated wholeheartedly in the effort to make the plan work so that production of fuzes would be speeded.

Over and above the benefits already cited, the plan has other advantages. It reduces costs of manufacture, balances production better among all companies, and helps eliminate unreasonable and unnecessary demands for expediting materials, tools and machines.

It weeds out the manufacturers operating on limited shifts or not competent to tool their machines efficiently. It aids the Ordnance districts in placing contracts at fair prices and relieves those districts of many irrelevant and time-consuming requests for help. It puts at the disposal of the Chief of Ordnance the skill and experience of the committee members as consultants on engineering, production, procurement and scheduling problems.

In less than six months the industry integration committee plan has been of invaluable aid to the Chief of Ordnance in increasing to an unexpected degree the output of mechanical time fuzes. The plan is being extended to a score of other items. It promises to be a vital factor in the Army Ordnance Department's program to produce "too much too soon" for the armed forces of the United Nations.

Standard Tools Speed Conversion

BY D. M. PATTISON, WARNER & SWASEY COMPANY

Here's a way to convert to war production without throwing out existing equipment and without waiting for specially made tools

HENRY BUCHWALDER'S PLANT used to make parts for electric ironers, wringers and washing machines. But the War Production Board has told him to forget ironers, wringers and washing machines and make parts for tanks.

So Buchwalder has a contract on his hands and has promised to produce in a volume far beyond anything his plant has ever even approached before.

He is up against an extreme emergency. Many of the parts he is scheduled to make are entirely different from anything his plant was previously tooled up for. The limits in the new specifications are way beyond those of his peace-time work. A thousandth or half a thousandth limit on his blueprints used to be exceptional. On the new work they are common.

Moreover, most of his equipment is old. The average age of his machine tools is almost twelve years. Some of his machines go back to the last war.

All Buchwalder's problems could be solved, if he could only equip his plant with new machine tools. But he can't get them right away. Without them, how is he going to step up production to the point where he can meet delivery schedules?

This is a typical dilemma of hundreds of small and average-size plants caught in the vitally important program of converting from peace-time to war-time manufacture.

Nevertheless, this problem has been solved in many plants. The key to the solution has been retooling old machine tools in order to adapt them successfully to the exacting requirements of war jobs.

In too many cases, manufacturers are under the impression that special tooling is necessary to accomplish this result. While it is true that some jobs

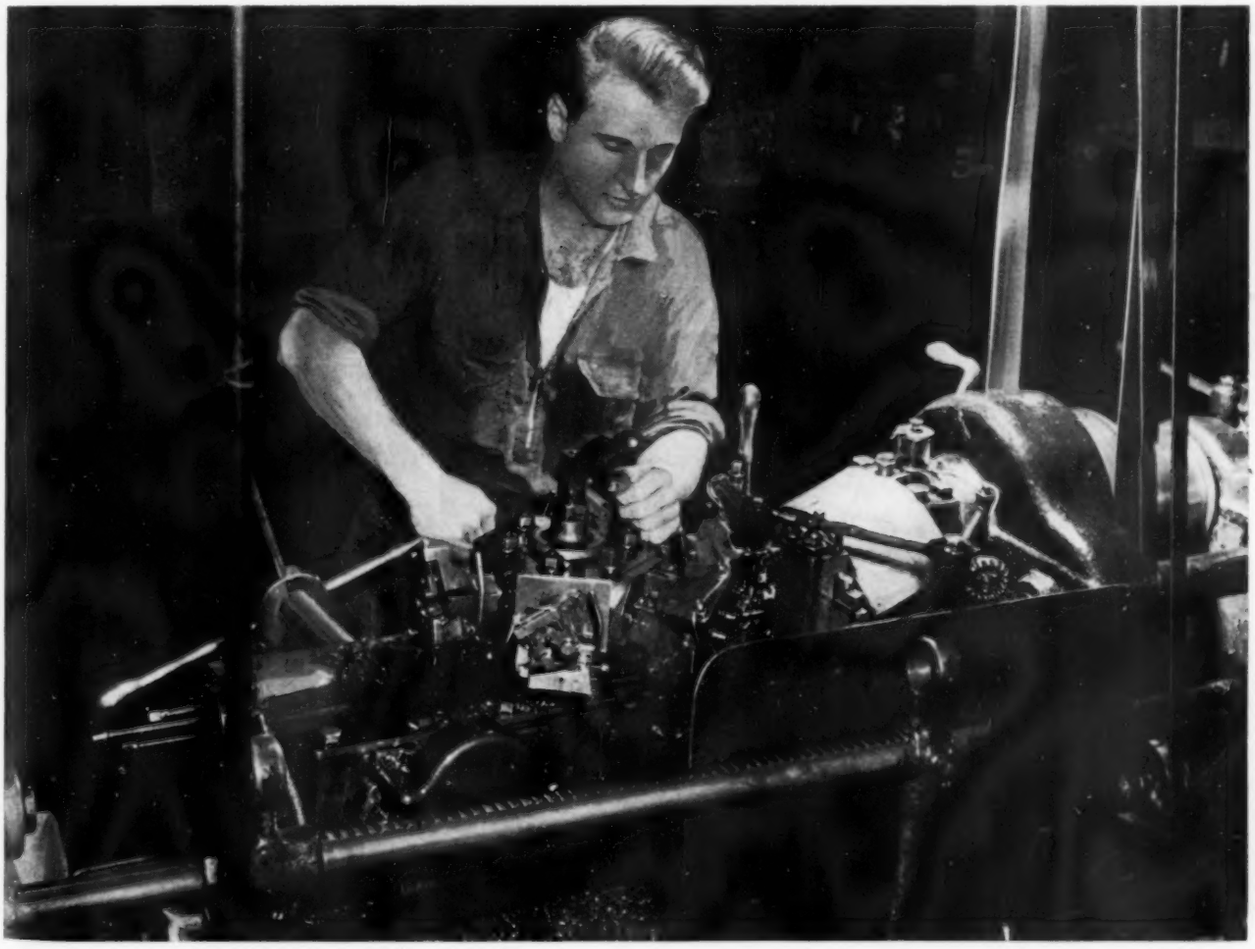


Fig. 1—This belt-driven bar machine, 28 years old, is now employed on cal. 0.30 cartridge case punches

require special tooling, practical experience has shown that standard tools, readily obtainable today from machine tool builders, can accomplish a large share of the conversion job.

By way of illustration are five examples of turret lathes converted by the intelligent use of standard tools.

The Scott & Fetzer Company used to make vacuum cleaners. Today its plant is completely converted to war work and in production 24 hours a day on armor-piercing shells, parts for naval gun equipment and similar ordnance material. This was accomplished by a comprehensive program of operator re-education and by reconditioning and retooling a considerable amount of equipment throughout the plant.

An old turret lathe, Fig. 1, was tooled up for the production of cal. 0.30 cartridge case punches. It was put into good condition by men in the toolroom who installed repair parts and equipped it with five new standard single-cutter turners. Although cartridge case punches are made of tough steel, which is difficult to machine, the work does not have to be extremely accurate. The old turret lathe, therefore, is doing an entirely satisfactory job.

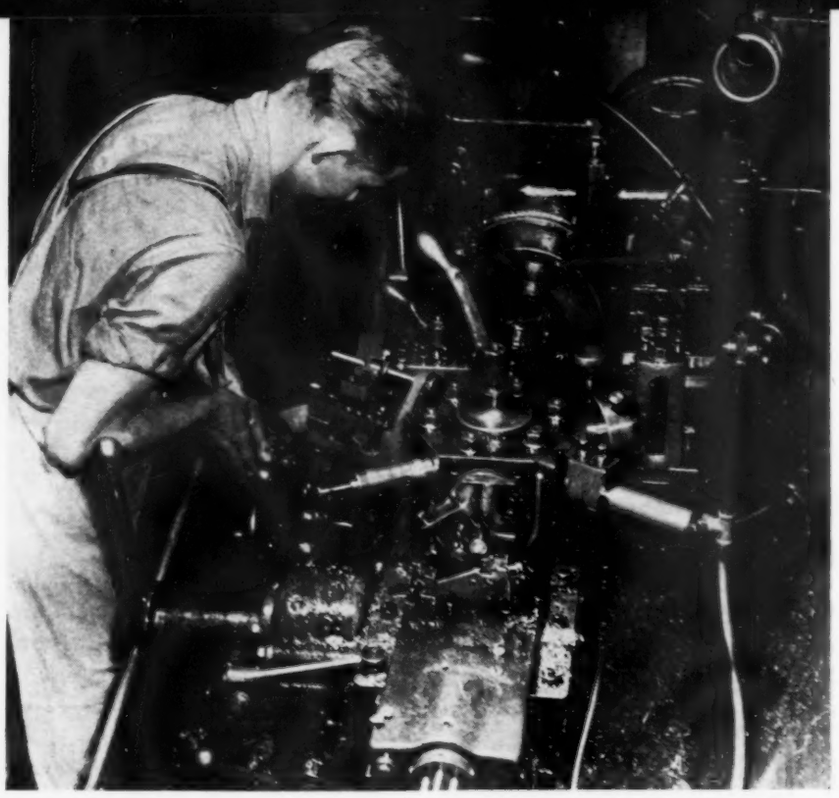


Fig. 3—Formerly idle for months at a time, this 20 year old ram-type turret lathe is today in regular production on valve bridge parts

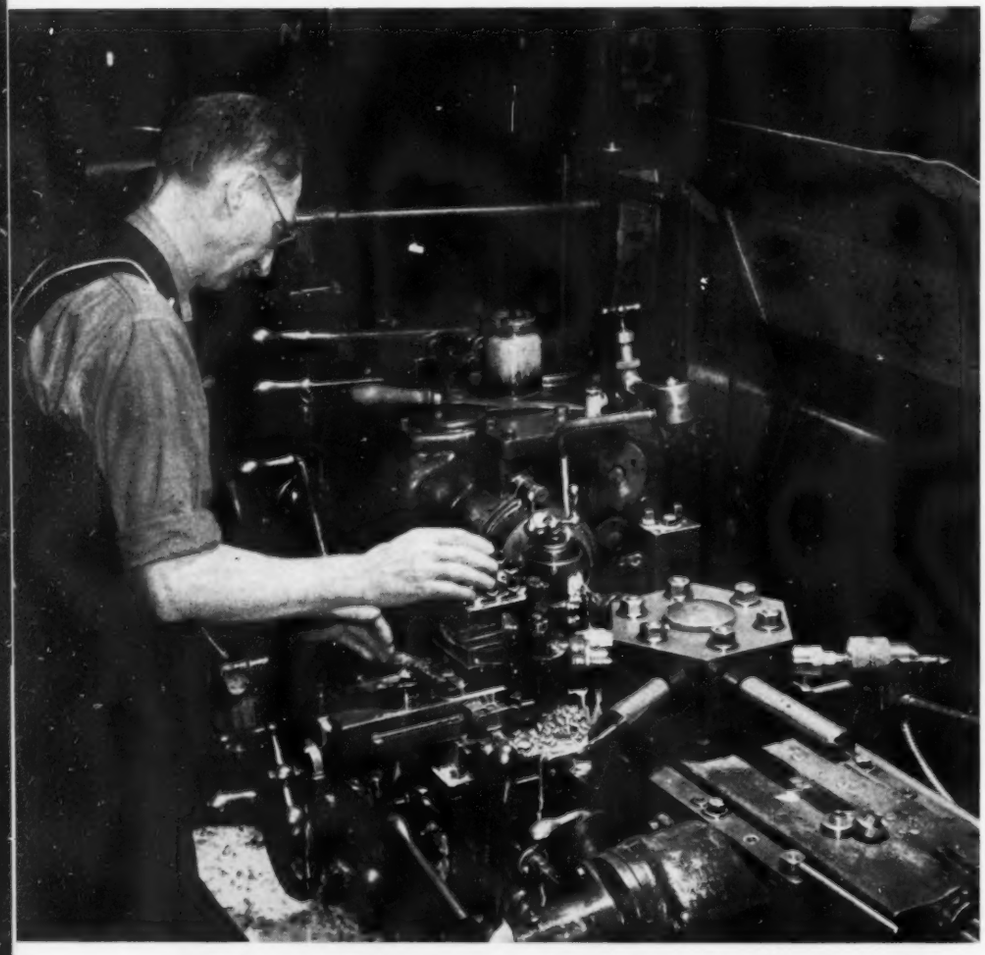


Fig. 2—A new slide tool, new drill sockets and drill chucks were added to equip this machine for turning out the hubs seen at the lower right

In another department in the same plant, two old engine lathes were equipped with square turrets and are likewise doing a satisfactory job on war work. All that was required was a little ingenuity and a few standard small tools purchased out of the catalog.

Retooled for Gun Controls

The Apex Electrical Manufacturing Company used to make washing machines. It has now swung over heavily to the production of control apparatus for the aiming and firing of naval guns.

A large battery of new turret lathes was purchased for the conversion, but the existing machines were also fitted in the program. Older equipment was rebuilt right at the plant and all the machines, later as well as older models, were retooled.

The turret lathe, Fig. 2, for example, was tooled up for the production of hubs for gun-firing control mechanisms. This machine is ten years old.

The operator, an old hand at turret lathes, is doing a much more accurate job than he ever had to do before. Most of the work at Apex never required extremely close limits, but the company has done a good job of re-educating old operators and training scores of new ones.

The Titan Valve and Manufacturing

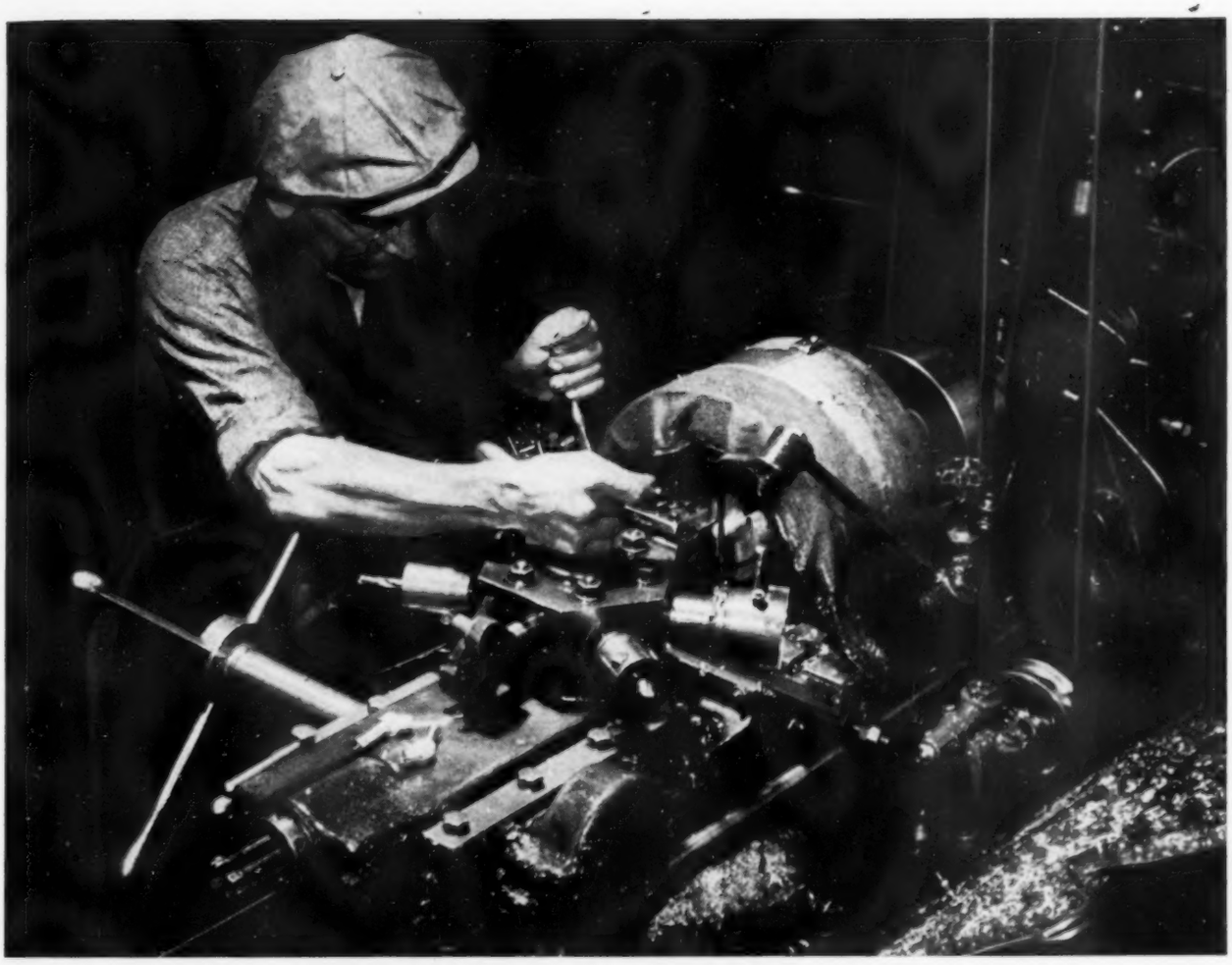


Fig. 4—This chucking machine was equipped with a revolving chuck, combination tool holder, drill sockets and other standard new tools. Only the chuck guard is homemade

Company was restricted to about a third of its normal peace-time production of thermostatic controls, but all its equipment made idle is rapidly being converted to war work. Use is being found for every machine. Already a 30-year old turret lathe, which might easily have been discarded, is back in production.

This 1912 brass machine was motorized, but it is still belt-driven. Someone might easily have said that there is no place in the war program for an antique of this kind with all hand feeds. But it is now doing a two shifts a day, day-after-day job on war work. It is shown rough machining brass end caps for range finders. These parts have to be finish machined to close limits, one diameter being held to two ten-thousandths, but the lathe is still good for first-operation work. It has been completely re-equipped with new tools including a cross-slide toolpost, single turning head and adjustable angle cutter holder.

The Marquette Metal Products Company has been manufacturing governors and other equipment for naval and aircraft engines for some time. With the rush of war orders, every available piece of equipment was pressed into service including three old turret lathes which were reconditioned and retooled.

One of these machines, Fig. 3, was used only when no other equipment in the plant was available. Today it is turning out valve bridge parts for diesel engines. The machine was slightly reconditioned and equipped with new tools including a single-cutter turner and a multiple-cutter turner. The new tools are all standard catalog items used as delivered except for the multiple-cutter turner which was fitted with a special block for turning the odd-shaped steel forging.

The P. A. Geier Company normally produces vacuum cleaners. Last spring some people were predicting that it would be impossible for this concern to use its equipment for war production. Tolerances on vacuum cleaner parts, it was said, are not closely limited, but on war work, they are. Yet today, this company is busy turning out aircraft parts—fittings for oil and gas lines, hydraulic lines for operating wing flaps, bomb racks and similar items.

The company reconditioned and retooled twelve old turret lathes. One, Fig. 4, is an old belt-driven chucking machine built before the last war. It is seen in production on airplane engine elbow fittings made of aluminum castings (note parts on ram of machine). Some limits are only one thousandth, and the threads are Class III, yet the parts are finished to size on this lathe. Parts must have a fine finish and be clean lest burrs get into the plane engine lines.

War production emphasis today is centering upon the conversion of smaller plants to war production jobs. In many of these plants a large share of machine tool equipment is of older types. Proper ingenuity in the use of standard tools will enable the manufacturer to adapt these old machines immediately to war production needs, without waiting for special tools or holding up production pending the arrival of new machines.

Gears and Gear Cutting

BY ALLAN H. CANDEE, GLEASON WORKS

Properly cut gears, regardless of their size, will transmit a smooth flow of power in a wide variety of mechanical designs

AS IN ALL technical fields, the design, manufacture, and application of gears have advanced considerably faster than the writing of up-to-date handbooks and textbooks. This article will present some ideas which should be both helpful and interesting.

The mechanism in Fig. 1 is part of a machine for generating gear teeth. Four different kinds of gears can be seen: spur gears, straight bevel gears, spiral bevel gears and a worm gear. In this application the gears are not heavily loaded, but they must be designed to resist wear, so as to maintain their accuracy throughout a long period of service.

Accuracy here means that the motion transmitted by the gears must be smooth or, mathematically, that the angular velocity ratio must remain constant to a precise degree. If any one of the gears drives another in an uneven manner, the performance of the machine is unsatisfactory.

In order to obtain this desired smoothness of motion, the gear teeth must be properly shaped. For instance if we look at teeth made in some random way like the "cogs" in Fig. 2, with sides slanted but straight, it is obvious that the forces at the various points of contact between the corner of one tooth and the side of another, would operate with varying leverages. The motion transmitted would be irregular and jerky. Such teeth might even lock together and prevent continued motion.

In any book on kinematics the chapter on gearing will show that for constant leverage and constant ratio of angular velocities, the lines of force at different positions of points of contact must all cross the line of centers at the same point. See Fig. 3. In such diagrams for two rotating gears there are two centers of rotation O_1, O_2, the line of centers O_1—O_2, points of contact P, Q, lines of force and the so-called pitch point M.

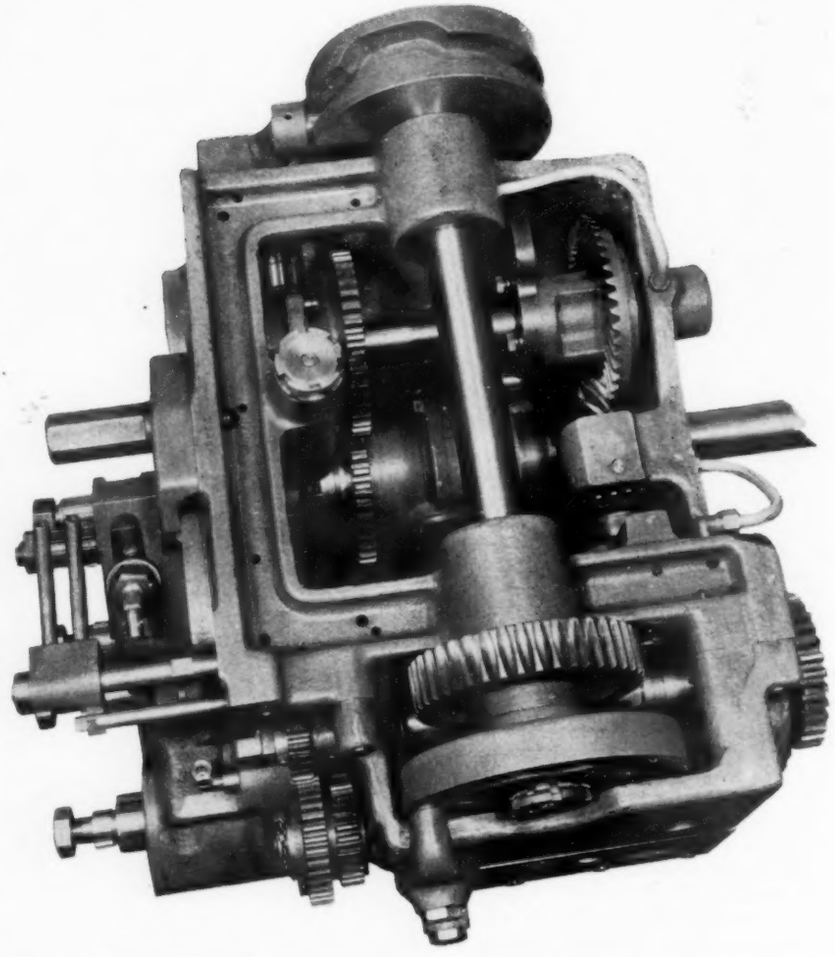


Fig. 1—Various types of gears are frequently found combined in one machine assembly as in this machine tool mechanism

Since kinematics properly deals with motion only, the concept of force may be, perhaps should be, excluded. Then the expression "line of force" is replaced by "direction of velocity normal to the contacting profiles or curves."

In the diagram at the left, the line of force or direction of normal velocity at P is in a different direction from the line at Q. They both pass through M.

At the right it is seen that the direction of normal velocity at a moving point of contact may remain constant. This is the case of gear teeth of involute form which are commonly used. Teeth with profiles of any proper shape to give the desired motion are generally referred to as conjugate teeth.

The foregoing diagrams show what are only cross-sections of gears and teeth. Actual teeth have length as well as thickness and depth. See Fig. 4. In the simplest gears, the teeth are of the kind commonly called "straight." In spur gears, of which the cylinder is the basic form, the tooth surfaces contain straight-line elements parallel to the axes. In bevel gears, which are basically cones, there are also straight-line elements on the teeth, which converge to a common apex point.

Spur gears operate on axes which are parallel. In some ways this seems perhaps the simplest and most natural arrangement. It happens just as frequently in machine design, however,

that it is convenient and also necessary to put gears on axes which intersect; and bevel gears are used just as commonly as spur gears. They transmit motion around a corner. Usually the axes of bevel gears are set at right angles, but gears can be and are made for any angle.

Fig. 5 illustrates some arrangements of angular bevel gears. It is merely a case of making the gears to suit the arrangement of the parts which they drive. One of the diagrams shows a slightly internal bevel gear. These can be cut under certain conditions but the gear-cutting machine manufacturer should be consulted.

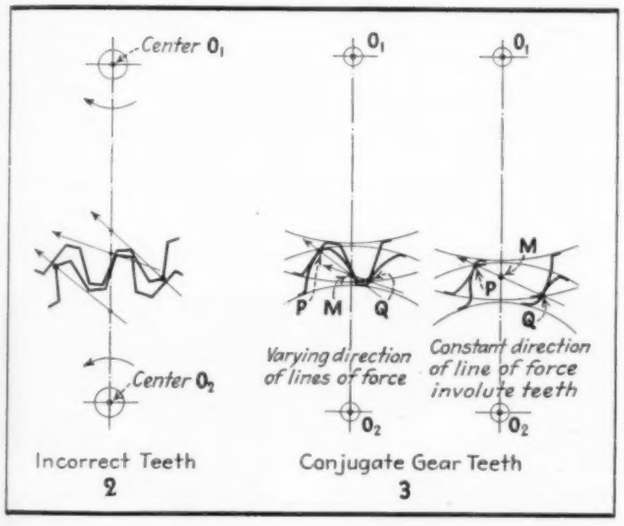
In the search for increased smoothness of operation, particularly at higher speeds and loads, gears were developed in which the lengthwise direction of the teeth is oblique. Thus, Fig. 6 shows helical gears for parallel axes and spiral bevel gears for intersecting axes. Such teeth are always preferred when speeds are high, because it is common experience that they are easier to manufacture so that they run smoothly and quietly. They also turn out to be stronger.

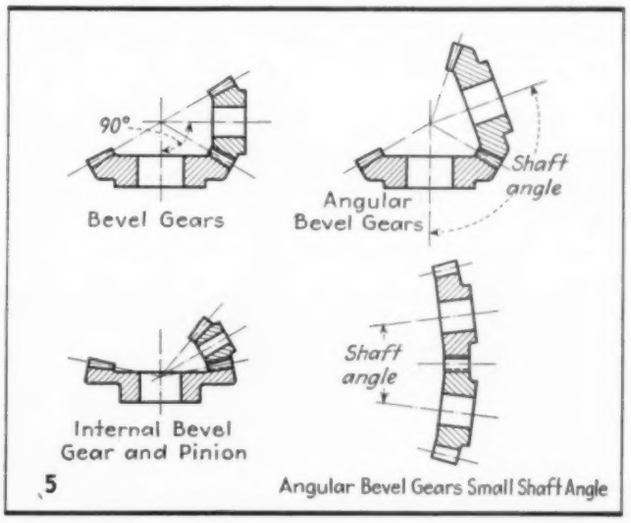
If the inclination across the face width amounts to one pitch or more, there will always be contact at the pitch point in at least one cross-section of the teeth. This means that continuous motion could be transmitted by the helix curves in the cylindrical gears or by the lengthwise tooth spirals in conical gears, independently of the profile curves. Since gear action does not then depend entirely on the profile, as is the case in straight teeth, satisfactory operation is easier to obtain and maintain under usual conditions.

It should be noted that oblique teeth affect the thrust loads in the direction of gear axes and require proper bearings to hold the gears in position. In double-helical, or herringbone gears, the thrust loads in the two halves balance each other.

In addition to gears with axes parallel and gears with axes intersecting, there are gears running on axes which are offset, namely, not in one plane. In Fig. 7 the worm and worm gear at the left represent an extremely old type of gear which has many important applications. Taken alone the worm is similar to a screw. If it has a single thread, it constitutes a gear with only one tooth; and high ratios are possible, like 360/1 for instance.

At the right is a hypoid gear and pinion which also operate on offset axes, but which are much newer. These look much like spiral bevel gears, and they are in fact made with similar cutters and machines. Hypoid gears with spiral teeth have been produced correctly and commercially only since 1926. Being able to place the pinion off center is ocasionally required by the arrangement of other parts; and hypoid gears can be made with precision equaling that of any other gear. Hypoid gears are used almost universally for the rear-axle drive in American cars.





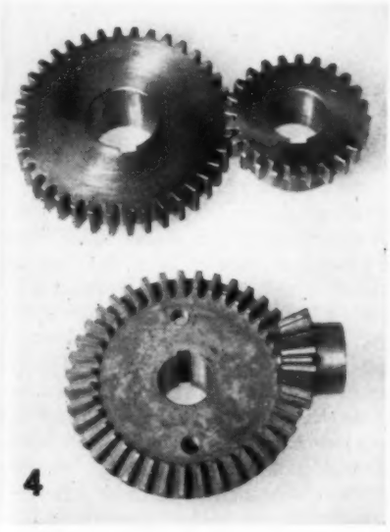


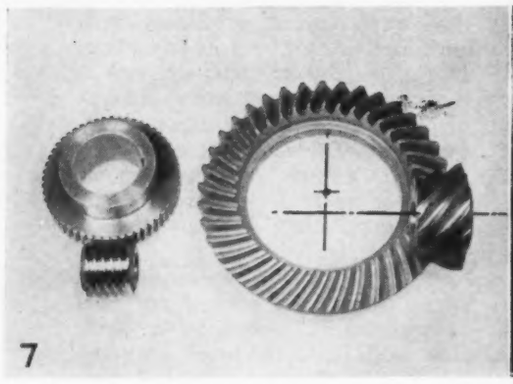
Fig. 2—"Cogs", or incorrect teeth, give a jerky motion. The teeth may stick or lock, the torque is uneven

Fig. 3—In conjugate gear teeth, all lines of force are normal to the profiles and intersect at the same point on the line of centers

Fig. 4—Straight-tooth gears may be spur or bevel, dependent on the positions of the axes

Fig. 5—Bevel gears are not limited to right-angle shafts but may transmit motion in any position shown

Fig. 6—Oblique teeth give a smoother drive and are particularly desirable for high speeds



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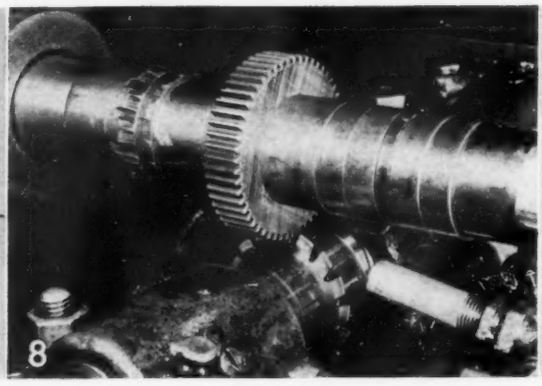

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Fig. 7—Gear axes, not in the same plane, are shown by the worm drive (left) and the hypoid drive (right)

Fig. 8—Gears were first cut by milling, their accuracy being dependent on the tool form

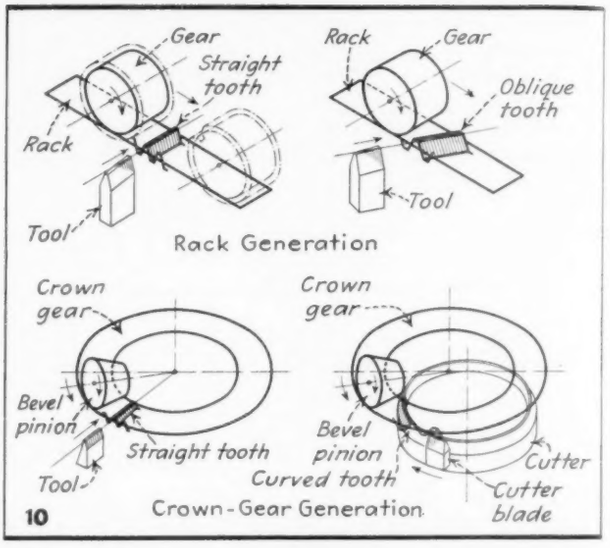
Fig. 9—When profiles of the rack teeth are straight lines, profiles of the pinion teeth are involute curves

Fig. 10—In generated gearing the cutting tool represents a tooth of the generating gear

Fig. 11—The generating cutter in a gear shaper is in the form of a pinion

Fig. 12—In gear hobbing, the generating tool is in the form of a helical gear or worm with gashes across the threads to make cutting edges

Fig. 13—Worms, today, are frequently machined on a thread miller, the same as screw threads



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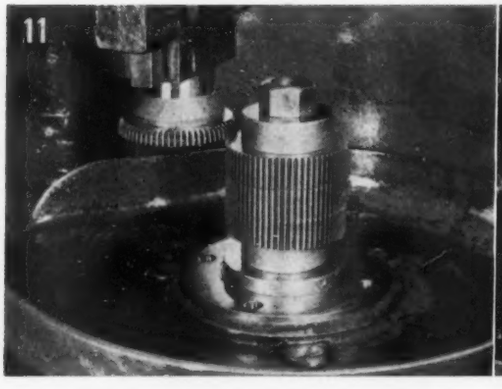

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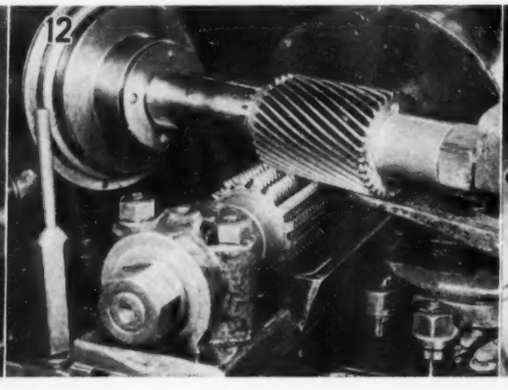

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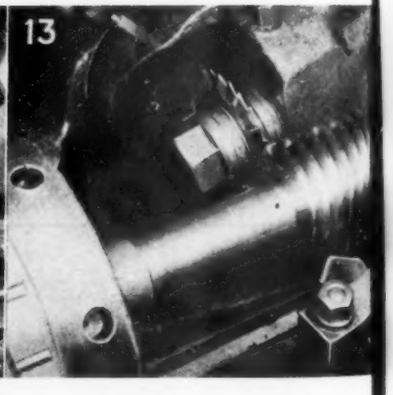


13

In the old days many gears were cast from patterns. In the later 1800's "cut teeth" came into use. These were produced by the simple milling process shown in Fig. 8. A rotating milling cutter of proper form is used to mill spaces between adjacent teeth. As the shape of the cutter is copied in the gear, every different gear calls for a different cutter. In practice, however, the same cutter can be used for a limited range of tooth numbers of a given pitch. Such cutters are still used for gear teeth, but in most cases they have been displaced by generating tools.

The rack and pinion, Fig. 9, are useful in introducing the idea of gear generation. The teeth of a rack are spaced along a flat surface and those shown are straight-sided. So in this case a straight-line, representing the rack profile, is conjugate to a curved gear tooth profile. The line and the curve roll against each other. The similarity of Fig. 9 to the diagram of a rack and gear in Fig. 10 is very direct; and the idea of gear-tooth generation has often been explained in the following way:

Imagine a plastic cylinder, made say of wax, to roll on a plane representing a rack; and suppose the rack to have a tooth as shown. The relative motion of the cylinder and plane would cause a groove or space to be rolled into the plastic blank, with sides conjugate to the rack tooth.

This principle can be applied to the generation of gear teeth in hard metal by causing a reciprocating tool to represent the rack tooth and letting the motion in a machine roll the blank slowly past the tool in the manner shown. Whether the teeth so generated are straight or helical depends merely

on the direction of tool reciprocation.

In a gear-generating process, the shape generated on a tooth is different from the shape of the tool. Thus in generation from a rack curved profiles are produced by straight-edged tools. By controlling the relative motion, different shapes are obtained from the same tool. The outstanding advantage of the generating method is that the same tool can be used to generate gears with any number of teeth. Also it is found that generating methods produce gears with greater accuracy than methods in which the individual tooth shape must first be ground on a tool.

Generation Determines Profiles

When generating bevel gears, the cutting tool usually represents a tooth of an imaginary flat crown gear; and instead of a cylinder, a cone rolls with a plane. In generating straight bevel gear teeth the tools reciprocate along straight lines; and in generating spiral teeth which are curved and oblique the most common method uses a rotating cutter in combination with the basic generating process. It is the generation which determines the shape of the tooth profiles, whereas the motion of the cutting tool proper determines the lengthwise direction and curvature of the teeth.

Coming to actual gear generation, Fig. 11 shows the Fellows gear-shaping process which is widely used to cut spur and helical gears. Here the cutter is in the form of a complete gear and is carried by a ram which reciprocates in the direction of the gear axes. Cutter and gear are rolled slowly together until all the teeth are generated.

Another equally common method of generating spur and helical gears is hobbing, Fig. 12. The hob and gear rotate continuously while a slow feed occurs in the direction of the gear axes. A hob may be thought of as a worm with gashes across the turns of thread to form a series of cutting teeth. Whether the teeth hobbed are straight or helical is merely a matter of gearing in the hobbing machine. Hobbing and shaping are both used over the entire range of gear sizes which may be given approximately as from $\frac{1}{8}$ in. diameter to 200 in. diameter.

Worm threads, like screw threads, used to be cut on lathes. It is now the more usual practice to mill them on thread-milling machines, Fig. 13. Many worms are of hardened steel and have their threads ground.

The obvious way to make a worm gear conjugate to a worm is to use a hob corresponding to the worm, Fig. 14. The difference from hobbing straight or helical teeth is that the axes of the hob remains in the central plane of the worm gear. The hobbing of worm gears is undoubtedly one of the oldest gear-cutting processes, much older than the hobbing of spur gears.

Most straight-tooth bevel gears are generated by reciprocating tools which work in pairs, Fig. 15. By using separate tools on the two sides, the thickness of the tooth can be made to taper in the desired manner. The tools have straight cutting edges and generate curved tooth profiles by employing the generating principle illustrated in Fig. 10. One tooth is finished at a time, and the machine indexes automatically to cut successive teeth around the gear.

Fig. 16 shows a small spiral bevel gear and its cutter in a generating machine. The cutter rotates at proper cutting speed, and after the sides of one space are generated, the machine automatically indexes for the next. The cutter in this picture is of 2-in. diameter. Cutters range in diameter from $\frac{1}{2}$ to 18 in. In many cases cutter and gear are of about the same diameter. For small gears, however, the cutter is likely to be larger than the gear.

Machines Have Wide Range

The machines for generating these curved, or spiral, teeth in bevel gears are adjustable through a considerable range, and can readily be set to cut teeth in any desired direction. When the spiral angle is zero, as at the right in Fig. 17, the name Zerol[1] bevel gears is applied. The thrust loads in spiral bevel gears are naturally more than in corresponding straight bevel gears in one direction of driving and usually require larger bearings. Zerol gears have thrust loads which are practically the same as in straights, and can be manufactured with the same equipment and methods as spiral bevel gears.

In Fig. 18 a small, narrow-face, Zerol gear is generated by a comparatively large cutter. The proportions, in fact, are unusual, but serve to show the wide variations possible in the use of a standard generating machine. The large cutter generates a great number of teeth before resharpening is necessary. Note the secure manner in which the gear is held on the arbor. This is done to obtain extreme accuracy.

Other finishing and manufacturing processes are burnishing, shaving, grinding and lapping.

[1] Name trademarked by Gleason Works.

Part 2 of this article will appear in an early number.

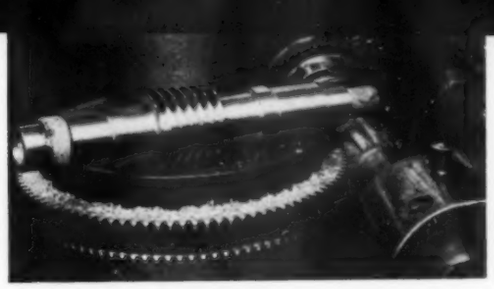


Fig. 14—The hob is the counterpart of the worm in cutting a worm gear on a hobbing machine

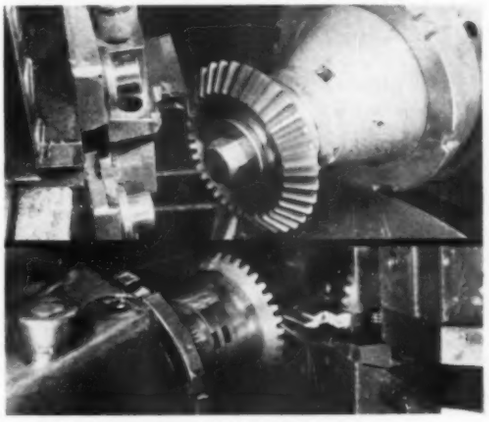


Fig. 15—Tools for generating a straight bevel gear have straight cutting edges and straight-line reciprocation. Profile shapes are generated by the principle shown in Fig. 10

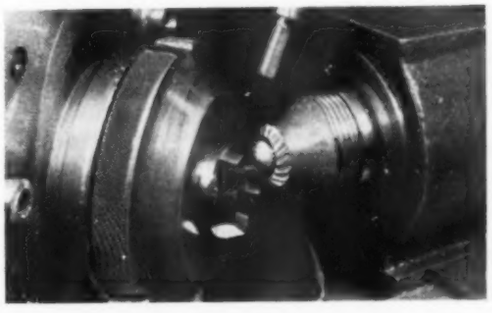


Fig. 16—For generating a spiral bevel gear the circular cutter produces curved teeth

Fig. 17—At the left is a spiral bevel pinion, at the right, a Zerol pinion with curved teeth but no spiral angle

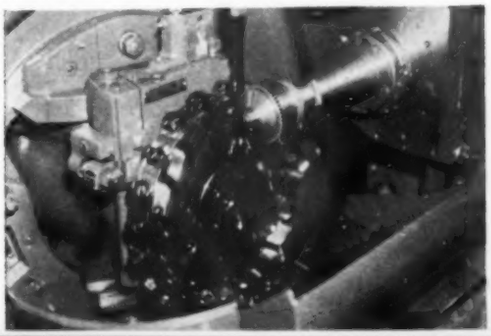


Fig. 18—A wide range of adjustments in a universal machine permits cutting a small Zerol pinion

Die-Casting Inserts Cut Costs

BY HERBERT CHASE

Alloys lacking mechanical and electrical properties for many uses can be employed if inserts are added. They help to reduce assembly and machining costs

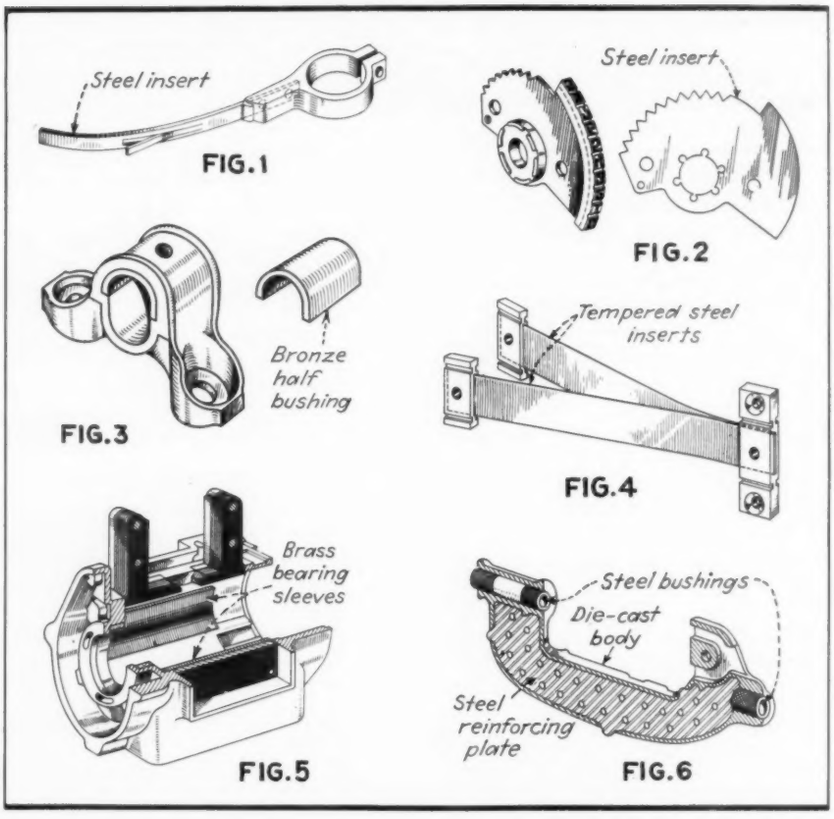
DIE CASTINGS do not have the strength of many wrought metals. They lack magnetic properties. Most types do not have the bearing characteristics of certain bronzes. They lack the friction properties of some non-metallic materials. They do not lend themselves to welding to steel.

But it does not follow that die castings cannot be used where these properties are needed; all of these properties are readily gained by the simple use of inserts cast in place and thus becoming, in effect, a part of the die casting.

Inserts in die castings, besides providing properties which the casting itself lacks, often greatly decrease assembly costs. They may also provide types of integral fastenings which otherwise would mean extra parts. Their use frequently results in contours which are more pleasing to the eye than they would be otherwise, and they make possible shapes which cannot be produced with equal economy and precision by other means.

The accompanying drawings illustrate the types of applications in which inserts yield specific benefits. Similar benefits may sometimes be gained by applying the insert after casting, but economy in so doing is likely to be sacrificed. The use of a die to position inserts relative to the casting or to each other often makes other fastening means unnecessary and uneconomical. There is, then, a saving in machine work, in assembly cost and sometimes in the elimination of fastening parts otherwise essential.

Producers of die castings are not always enthusiastic about the use of inserts, chiefly because they slow the casting cycles, and involve occasional difficulties productive of delays. But die casters are usually quite willing to apply inserts if given fair compensation for the extra operating cost.



1. A projecting steel insert in this die casting is much stronger and more resistant to bending than if the whole piece were die cast

2. Both the rim and hub of this check-writing machine part are die cast. The steel inserts provide harder and more wear-resistant teeth than if these were made of the zinc alloy forming the remainder of the piece

3. In this zinc-alloy casting, the insert is a bronze half sleeve providing a better bearing surface than the casting itself. Full sleeved bushings may be either cast or pressed in place

4. Two flexible springs of tempered steel form inserts in the three cast blocks shown here. The zinc alloy is cast at a temperature too low to draw the temper of the steel. To produce an equivalent assembly in considerable quantities by other means, a greater cost would be involved

5. Four magnet steel pole pieces and brass bearing sleeve constitute the inserts in this magneto housing. The inserts possess properties not available in the aluminum alloy of the die-cast frame. Assembly, which would be expensive and require several extra parts if accomplished by other means, is simplified by casting the insert permanently in place

6. Bending and shearing strengths of this pipe-cutter frame are increased by the perforated steel plate insert. Internally threaded steel bushings provide stronger and more wear-resistant threads than if tapped in the zinc alloy casting itself. The zinc alloy is die cast around these

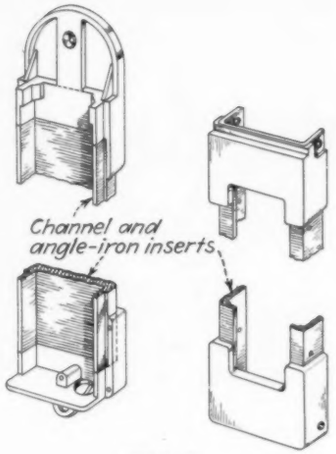


FIG. 7

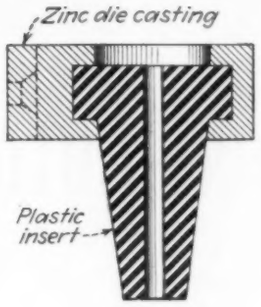


FIG. 8

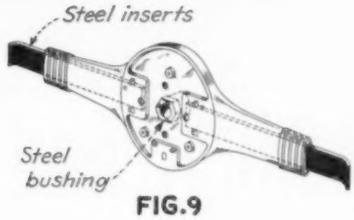


FIG. 9

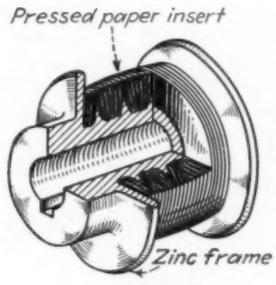


FIG. 10

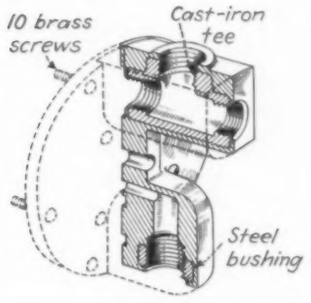


FIG. 11

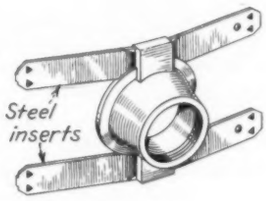


FIG. 12

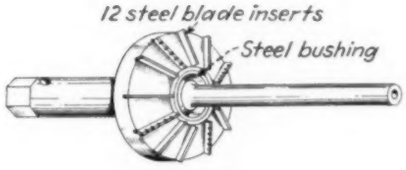
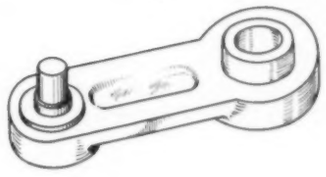


FIG. 13



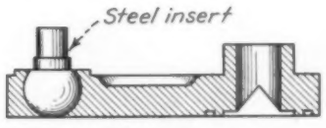


FIG. 14

three parts to give the cutter the desired external shapes, as well as to make it lighter than a forging

7. To form industrial-thermometer frames, the ends of which are shown here, zinc alloy is die cast around each end of rolled or extruded aluminum shapes 39 in. long. The die is smaller than it would be if the entire case were die cast

8. A plastic insert, molded separately from phenolic materials and constituting a dielectric, is cast in place. The zinc alloy might slightly char the extreme surface of the plastic where it comes in contact with the metal, but would not affect its utility

9. Strips of $\frac{7}{8}$x$\frac{1}{4}$-in. steel, and a steel center bushing are the inserts for this steering wheel spider die cast in zinc alloy. The inserts provide extra strength and hardness, while the curved ends of the strip can be welded readily to the core wire of the wheel rim. Besides saving machine work, the die casting gives a smooth and attractive external shape

10. Taper inserts in this pulley form the friction surface with which the belt contacts. The flanges and hub are die cast, the zinc alloy contacting the paper while still in molten form. Chilling takes place so rapidly that only a slight charring of the paper surface occurs

11. No less than 12 inserts—ten brass screws, a steel bushing and a cast-iron tee—are applied in this flanged die casting. These parts could not be fastened readily to the flange by means other than die casting. The face of the flange, which has two annual grooves, requires no machining

12. Projecting portions of this die-casting are steel stampings with sharp prongs for fastening the assembly to the curved surface of fiber conduit. The steel gives flexibility and hardness to a degree not attained by the casting itself

13. Hardened steel blades, a central bushing and zinc die-cast body make up this valve-seating tool. The one-piece assembly requires little or no machining. The central stem is pressed into the bushing

14. The ball-ended crankpin insert of this die-cast windshield wiper link is made in a screw machine. Subsequently, the insert is struck a blow in a press to enlarge slightly the recess for the ball. This permits the ball to turn freely in the socket as the wiper oscillates. Such construction eliminates using a split socket

FLAME HARDENING WITH CITY GAS—3

Manual and Semi-Automatic Set-Ups

BY R. F. APTER and HARRY W. SMITH, JR., THE SELAS COMPANY

Flame-hardening set-ups using premixed gas and air as fuel can be used for small lot as well as high production runs

THERE IS NO REASON why gas-air flame-hardening, with its relative simplicity and economy, cannot be fitted to intermittent small-quantity work. Its flexible apparatus can frequently be rearranged by the operator for different work pieces.

A notable example is the small bench assembly, Fig. 10, designed and built for the heat-treatment of gun mechanism parts in the plant of a large automobile manufacturer.

The unit was originally intended for only two production items and, therefore, possesses two heating stations, one on either side of a common quench tank. At the left station, star shafts are manually placed on a small turntable rotating at 18 r.p.m. and heated at the top end for 51 sec. by two opposed compacted or superheat combustion burners. The dummy bar-and-bolt assembly shown in the photograph merely simulates the actual work piece; the top projection of the actual part has wear areas requiring hardening. An adjustable automatic timer is provided at this station to reduce the premixed gas and air input to the burners from full-on to a pilot or idling input after the 51 sec. have elapsed.

The other hardening station, at the right in Fig. 10, utilizes six smaller compacted or superheat combustion burners and consists essentially of a slide along which trigger latches are pushed in a row to run the gauntlet of the burners in about 15 sec. before dropping into the quench tank. Burners are so disposed that they heat just the right portion of the latches as they slide past. Production at this station is about 65 latches per minute.

This unit has been rebuilt so that it can handle no less than 15 different anti-aircraft gun parts, in addition to the original two, on intermittent cycles. Each burner has been mounted at the end of a three-section supply pipe, assembled with swivel joints between the sections and in different planes. Thus, any of the eight burners can now be manipulated into any position, much in the manner of a dentist's drill.

A series of fixtures has also been made to accommodate various work pieces, and a complete schedule of burner arrangements and time cycles worked out for each item. Thus, the operator can run a dozen or so of a certain piece, spend a few moments rearranging burners and attaching new fixtures, and proceed with a totally different item of production.

Single-piece production set-ups are also reasonable with gas-air hardening methods. Fig. 11 shows how the radiant burner has been used to heat the cutting edges of two shear knives locally before quenching. Observe that the burners in this case were temporarily mounted on laboratory ring stands for the single heat-treatment required. Fig. 12 shows an adaptation of the circular, converging, compacted combustion burner to hardening the area around the striker-pin hole on a complex machined part for test purposes.

Perhaps the greatest field of usefulness to date for flexible, semi-automatic arrangements of gas-air flame-hardening burners is in heat-treating transmission gears for machine tools. Such users want to harden gears of various sizes, shapes, pitches and degrees of

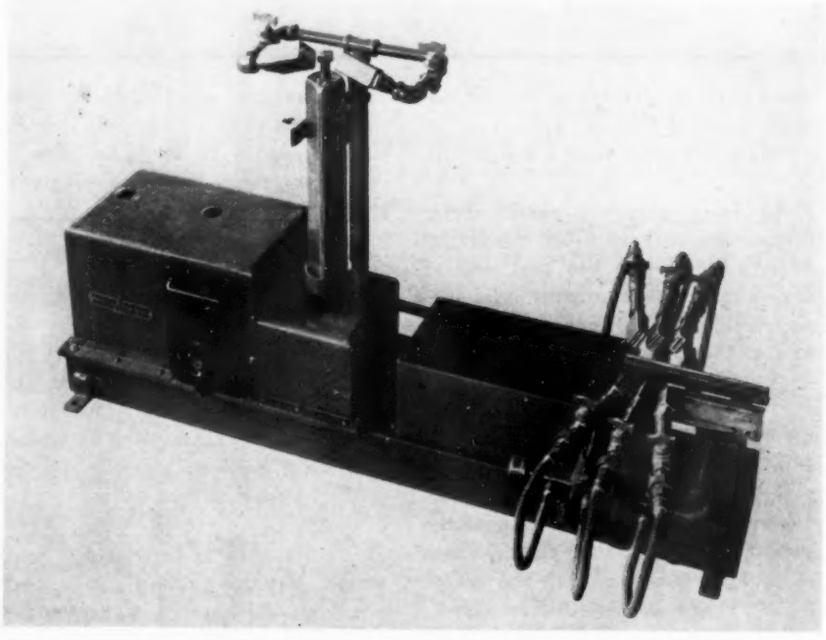


Fig. 10—Originally developed for gas-air flame-hardening of two small gun parts, this unit has been revised to permit hardening 15 different parts on intermittent cycles. Any one of eight burners now can be manipulated into any required position

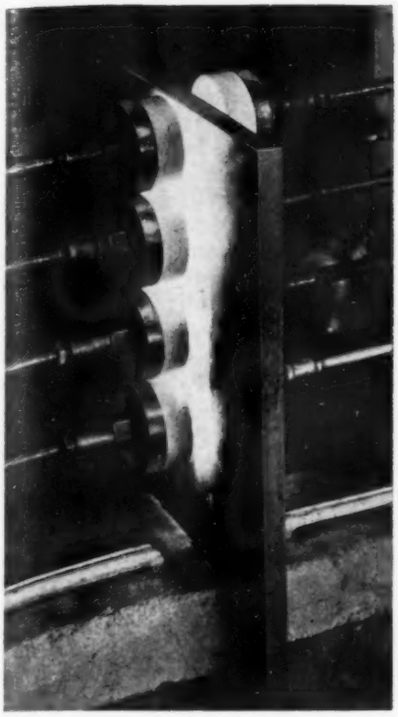


Fig. 11—Radiant-cup burners here are set up for heating locally the cutting edges of two shear knives prior to quenching. This is a temporary laboratory set-up which indicates the possibility of using such burners for flame-hardening

complexity. One manufacturer of multiple-drilling and broaching machinery has adapted gas-air flame-hardening in a noteworthy manner. Fig. 13 shows the essential details of his arrangement, utilizing a machine mechanism already on hand.

A circular gas-air manifold *A* consisting of bent and welded square pipe is fitted at 24 stations around its periphery with slotted bars such as the one shown at *B*, through which protrude radial rods *C*. A compacted combustion burner is located at the central end of each rod. Each rod may be adjusted through simple methods so that: the burner outlet can be at any distance from the axis of rotation of the work arbor *D;* the slot of the burner can be disposed at any angle (by bar rotation) with respect to the face of the gear being treated; the burner rod may be shifted left or right at the slotted bar so as to locate burners nearer to or further from the plane of the manifold; and the angle between the burner rod and the arbor axis may be varied 30 or 40 deg. either way from the normal orthogonal position illustrated.

Each burner is supplied with fuel from the circular manifold through a flexible connection *E*. Thus, any arrangement of burners around the work rotating on the arbor can be quickly set up to heat in the manner desired. The gears in this instance rotate on the arbor at a uniform speed of 18 r.p.m. The time elapsing before the two ejector pins on either side of the arbor push the gear *F* into the quench tank and the burners throttle from "full-on" to "pilot" consumptions, is regulated by manual presetting of the dial control.

The smallest gear handled in this set-up is 1-in. in diameter by $1\frac{1}{4}$-in. across the face; the largest is 11-in. in diameter by 4-in. across the face. The minimum time under full heat is 15 sec.; the maximum is 8 min. The operator can bring a 4-in. face gear to heat within 30 sec. of the time it takes him to bring an otherwise identical 2-in. face gear to heat. It is reported that scaling is "insignificant and wire brushing is all the gear needs after quenching" to prepare it for use.

Many of the gears are double and triple gears of the type shown at *G* in Fig. 13, and others are on splined shafts *H* or hubs, and may even incorporate clutch faces. The weights of the gears handled range up to 65 lb. The unit has been operated satisfactorily both upon manufactured gas and upon natural gas, the utility supplying fuel having changed over within the past year.

A similar arrangement with 36 rather than 24 burner stations, with a vertical rather than a horizontal axis, and with the burners-and-manifold assembly rotating around stationary work, rather than the other way around, is successfully hardening the face of a herringbone gear 4 in. broad and about 24 in. in diameter. This gear constitutes the main wheel drive of well-known heavy-duty road making and agricultural machinery.

In this instance, the piece weighs 175 lb. and is under high heat for 6 min. To quench, the massive gear is lowered from the firing station into an oil spray chamber which fills up to provide total immersion as the spraying progresses and to eliminate hazards of oil fires. This combination spray and immersion quench is regulated to a time-quench schedule, the oil rapidly and automatically draining from the tank at the end of a predetermined time interval. A case-history record of economy in connection with this installation is worth noting.

The user employed furnace hardening methods prior to the installation of the gas-air flame-hardening set-up. When the unit was first installed and a few of the huge herringbone gears had been run to establish cycles and operating techniques, it was suggested that the use of the apparatus as a flame-annealer might permit the reclamation

Fig. 12—Here, a converging type of compacted combustion burner is being used to heat the cartridge seat on a gun part. Note that the heat is confined to the area to be hardened

of a large stock of warped gears spoiled in previous furnace operations. The reclamation was attempted, and for six months this unit has been operated only in this manner to reclaim, to date, no less than $11,000 worth of gears previously scrapped.

The technique is simply to heat the gear to normalizing temperatures and permit it to cool in air. It is then remachined and brought back to the unit for the hardening cycle involving the spray-immersion quench.

In another premixed gas-and-air set-up for gear hardening, the burner-ring is so arranged that it may be bolted to the T-slotted table of a standard milling machine and later removed (after several dozen gears have been hardened) in order to resume machining operation on a fresh batch of gears. There is a telescopic connection to each "superheat" burner head so that quick adjustment may be made to adapt burner orientations and spacing to the gear being hardened. Quenched by manual agitation in oil, the gear is picked off the arbor by a simple expanding tong inserted through the bore of the gear by way of a wide slot in the arbor shaft. A heat-shield just behind the gear protects the milling machine from any "splash" heating during hardening periods.

In the case of a $3\frac{1}{2}$-in. gear, $1\frac{1}{4}$-in.

thick with a 1-in. bore, six medium-sized burners are used for a heating period of 1 min. 50 sec., during which time a mixed gas of 800 B.t.u. per cu. ft., premixed with 7½ volumes of air, is consumed at a rate of 220 cu. ft. per hr.

In all arrangements where burners are not permanently fixed in location by the manufacturer of equipment—that is, where the user adjusts burner placement to accommodate different work pieces—it is important to observe certain practices which will prolong burner life.

The compacted combustion burner must be refractory lined and must have a metal housing to protect it against the rigors of shop handling. Among the few deleterious influences to which such burners are susceptible is excessively heating the flat sides. If simple precautions are taken in this particular, longer service is likely.

Many users are still employing the same burners supplied with the original installation, and these service records run upward of eight or nine months despite continuous operation at high rates. The techniques diagrammed in Fig. 14 suggest methods of eliminating the side heating of burners. When handling double gears as in *A*, the burners treating the smaller segment should be carefully located to provide maximum air circulation around the burner and to avoid the close juxtaposition of burner sides to large masses of hot metal such as represented by the larger gear component.

When arranging slot-type burners about a wide-faced gear, it has been found better to place the length of the burner slot at right angles of the axis of rotation of the gear and across the teeth, rather than parallel to them. This seems odd at first glance because it is important to get even heating over the full width of the gear face. Even heating, however, can equally well be accomplished by staggering the burners as in *B* and thus eliminating the side heating of each burner by radiation from its neighbors. By so doing, also, a greater opportunity is afforded for the sheet of superheated gases issuing for each slot to penetrate between the gear teeth as the gear rotates within the ring of burners.

Control of the location of the heat-line (or boundary between hardened metal and soft body metal)—be the piece a gear, a saw, a knife, a mechanism part or some other metal product—is commonly accomplished simply by directing the heat from the flame-hardening burners only upon the area to be hardened. However, two other interesting methods of limiting the heat-line have been adapted. At *C*, in Fig. 14, the part is incased in a heavy metal fixture which allows only the region to be hardened to protrude into the line of fire. The fixture is of such heavy mass and fits the work-piece so closely that it tends to cool the main body of the machined part.

Obviously, this technique is valuable only where the fixture is not used for sustained production; otherwise the fixture itself would gradually heat up, and the chilling effect of its highly conductive mass would be negated. Water cooling of the fixture would, of course, equip it for sustained production.

The fourth and final installment of this series will appear in an early number.

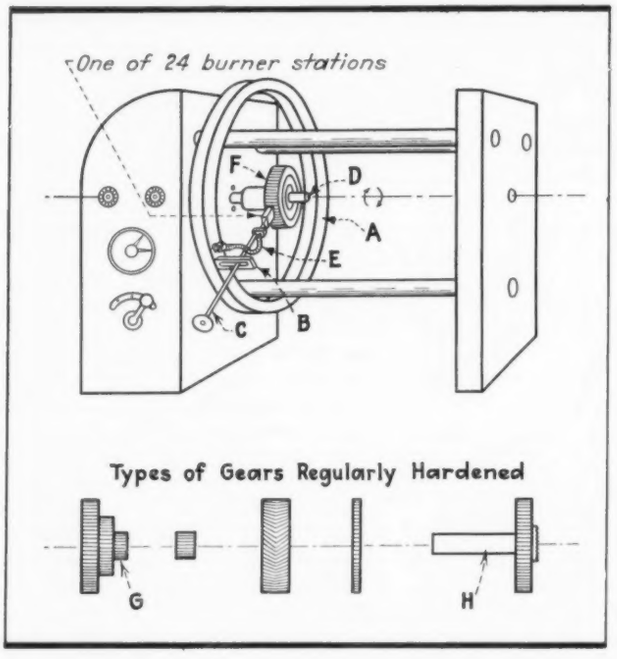


Fig. 13—The above sketch shows the essential details of a gas-air flame-hardened unit set up to heat-treat transmission gears in a machine tool builder's plant. The circular manifold *A* is fitted at 24 stations around its periphery with slotted bars *B*, through which protrude radial rods *C*, each of which supports a "compacted" combustion burner. Each burner outlet can be set at any desired distance from the work arbor *D* and is supplied with fuel through a flexible connection *E* from the circular manifold. When the proper heat has been attained, the gear *F* is pushed from the arbor by two ejector pins, and falls into the quench tank set below the machine

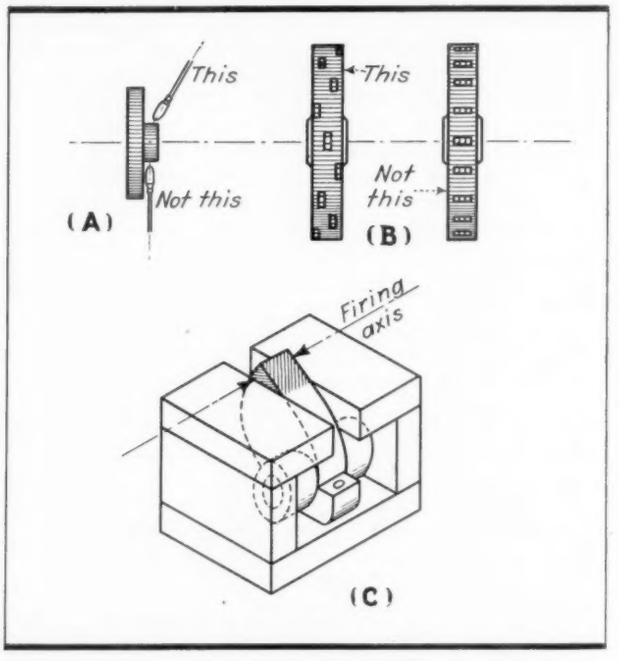


Fig. 14—To avoid extensive heating of the flat sides of gas-air burners, the burners should be located to provide the maximum of air circulation around the burner as shown at *A*. When flame-hardening gear teeth, slot-type burners should be placed so that the length of the burner slot is at right angles to the axis of rotation of the gear, and across the teeth, rather than parallel to the teeth, as shown at *B*. At *C* is shown a fixture used to confine the heating of a cam to the surface which is to be hardened. The heavy mass of the fixture keeps the main body of the cam cool, while heat is being applied to the tip of the cam to be hardened

The majority of ordnance inspectors now being trained at Carnegie Tech are women. Many of the students are sent to the school directly from plants manufacturing ordnance equipment

Teaching Aids for Inspectors

BY CHARLES B. STANTON, ESMWT ADMINISTRATOR, CARNEGIE INSTITUTE OF TECHNOLOGY

Novel devices facilitate the training of ordnance workers and cut schedules at Carnegie Tech from twelve to nine weeks

CARNEGIE TECH has established intensive courses for training army ordnance inspectors. One of the aids used to advanatage by the instructors is a series of charts, each of which tells at a glance whether or not a student has gaged correctly the part given him for inspection. All of the charts, including those for shell, shell cases, fuze bodies, fuze components and diverse castings for ordnance equipment, are similar to the one shown here for the booster body of 75-mm. shell.

Each chart shows the drawing of the part, all the gaging points, and the gage numbers; also, it lists the number of parts kept on hand for inspection and gives the correct reading for every point gaged on each individual part. For example, when using the chart for 75-mm. booster bodies, the instructor gives each student several of the 111 bodies kept in the stockroom; each body is stenciled with the corresponding chart number. The student gages the required points and records the results on paper, marking each point "OK," "plus" or "minus." The instructor then checks the notations against the chart to determine without delay the accuracy of the students results.

Another innovation in the training of inspectors at Carnegie Tech is the molding in clay of simple objects to enhance blueprint reading—all dimensons are given on standard engineering drawings. In all, 60 hours are devoted to blueprint reading and technical sketching, 30 hours for lectures and 30 hours in the laboratory.

These courses for inspectors are a

OUTLINE OF INSTRUCTION

SUBJECT	*Lecture and Recitation*	*Laboratory*	*Preparation*	*Total Hours*
Introduction	3	0	0	3
Mathematics	36	0	18	54
Blueprint reading and sketching	30	33	27	90
Materials of industry	27	27	26	80
Manufacturing processes	36	18	36	90
Inspection practice and specifications	36	0	33	69
Inspection laboratory	9	105	0	114
Totals	177	183	140	500

part of the Engineering, Science and Management War Training program conducted in universities and colleges under the auspices of the U. S. Office of Education. At Carnegie Tech, each student attends classes 40 hours each week for nine weeks, a total of 360 hours; in addition, 140 hours outside preparation are required. Previously, the course was given for twelve 40-hour weeks, or 480 hours, with 140 hours outside preparation.

Students for the inspection course were originally selected from applicants with one year college training or its equivalent in basic engineering subjects such as trigonometry, chemistry and physics. Recently however trainees without college credits have been selected from workers in ordnance factories and sent to the school, receiving for this a wage equivalent to that earned in the plant. It was assumed when setting up the course that trainees, with or without college training, would have little if any knowledge of blueprint reading, materials and processes of manufacturing, or inspection practice. Consequently, the course for inspectors were set up to overcome these deficiencies, as is evident from the accompanying outline.

Trainees study arithmetic, geometry and trigonometry and apply these in calculation of dimensions, angular measurements, tolerances, screw-thread components, gear components and sine bar settings.

Lectures are given on materials of industry, which include (1) composition of ferrous and non-ferrous metals. (2) physical properties, (3) relation of composition and structure to physical characteristics, (4) effects of impurities, alloying elements and heat-treatment, and (5) industrial applications of the materials. The 27 hours in the laboratory on this subject is devoted to tensile, compression, flexure and torsion testing of materials, as well as to non-destructive testing by radiograph and Magnaflux.

Graduate inspectors are required to have some knowledge of the function and operation of machine tools and metal-working equipment. To supply this, 48 hours are devoted to manufacturing processes—36 hours in the classroom and 18 in the shops. Also included is instruction in the principles and applications of jigs and fixtures, welding equipment and hand finishing tools.

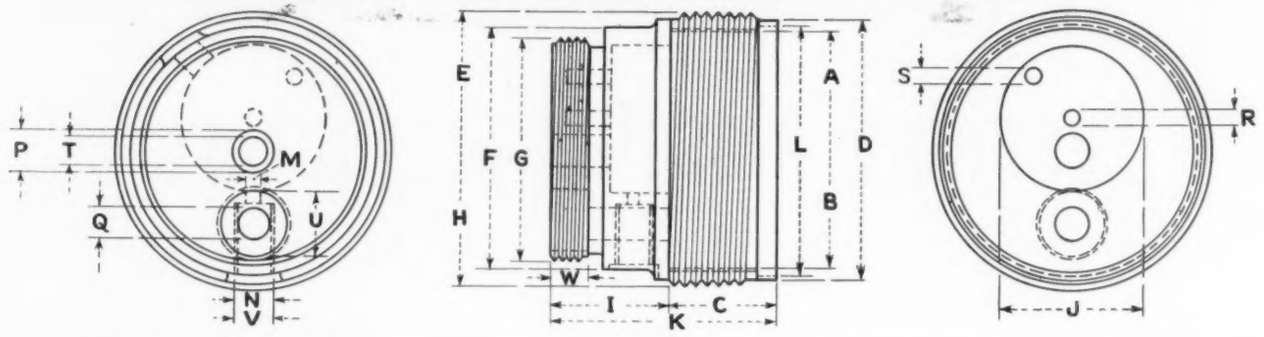
Inspection practice of course predominates with 45 hours lecture and 105 hours at inspection benches. Classroom study and outside preparation give the trainees necessary information on gage design and application. Inspection practice includes:

1. Checking dimensions of finished rectangular and cylindrical parts with steel scales and outside calipers.

2. Inspsecting cylindrical and rectangular parts with solid "go" and "not go" snap gages.

3. Inspecting parts with adjustable "go" and "not go" snap gages.

INSPECTION CHART FOR BOOSTER BODIES OF 75-MM. SHELL



PART No.	A			B			C			D			E			F			G			H			I			J			K		
	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.
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PART No.	L			M			N			P			Q			R			S			T			U			V			W		
	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.	+	−	O.K.
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Dimension U★ = Length of engagement *Dimension V● = Pitch diameter*

As an aid in sketch work and blueprint reading, students in ordnance inspection courses mold simple objects in clay, thereby reducing teaching time. Dimensions are taken from engineering drawings

GAGES FOR BOOSTER BODIES OF 75-MM. SHELL

LOCATION	TYPE OF GAGE	PURPOSE
A	" Not go " snap	Minor diameter of internal threads
A	" Go " snap	Minor diameter of internal threads
B	Plug	Pitch diameter of internal threads
C	Plug	Depth of internal threads
D	Snap	Shoulder diameter
E	Snap	Major diameter of external threads
F	Snap	Shoulder diameter
G	Snap	Major diameter of external threads
H	" Go " ring	Pitch diameter of external threads
H	" Not go " ring	Pitch diameter of external threads
I	.....	.....
J	Plug	Boss diameter
K	Snap	Over-all length
L	Plug	Interior end diameter
M	Plug	Diameter and concentricity
N	Plug	Minor diameter of internal threads
P	Plug	Counterbore and 45-deg. profile
Q	Plug	Hole diameter
R	Plug	Hole diameter
S	Plug	Hole diameter
T	Plug	Hole diameter and concentricity
U	Plug	Pitch diameter of interior threads and length of engagement
V	Plug	Pitch diameter of interior threads
W	.....	Depth of recess

NOTE: The gages are used at the designated locations on the chart on the opposite page. Each student gages each point and records its condition. Instructors check the results from the chart, rather than with gages. This cuts instruction time materially.

4. Inspecting parts with "go" and "not go" plug gages.
5. Inspecting diameters with ring gages.
6. Inspecting tapered holes with taper plug gages.
7. Inspecting tapers with taper ring gages.
8. Checking finished parts with dial bench gages.
9. Checking radii of fillets and rounded corners.
10. Checking threaded parts with thread plug gages.
11. Checking threaded parts with thread ring gages.
12. Measuring diameters of cylindrical parts with micrometers.
13. Checking the width and thickness of finished rectangular parts with micrometers.
14. Measuring cylindrical parts with vernier calipers.
15. Measuring inside diameters with vernier calipers.
16. Measuring hole diameters with inside micrometers.
17. Checking outside diameters using spring caliper and vernier caliper.
18. Checking inside diameters using spring caliper and micrometer.
19. Measuring depths of slots and counterbored holes from flat surfaces with micrometer depth gage.
20. Measuring depths of slots from flat surfaces using vernier depth gage.
21. Checking parts with dial indicator, using surface plate.
22. Checking run-out of cylindrical parts held between centers.
23. Measuring angles with universal bevel protractor.
24. Checking diameters with micrometer having adjustable anvils.
25. Checking wobble of a gear blank.
26. Checking concentricity of cylindrical parts, threaded parts and holes.
27. Checking ring cuts and shoulders of cylindrical parts.
28. Checking gear teeth with gear-tooth vernier caliper.
29. Inspecting diameter and concentricity of a circular groove.
30. Checking keyways for position, width and depth.

The Office of Education has received an appropriation of $30,000,000 for the fiscal year 1942-43 to continue the training of engineers, chemists, physicists, production supervisors and inspectors. In 1940-41 and 1941-42 appropriations of over $6,000,000 and $20,000,000, respectively, were made for this work. In the former year, courses at 144 institutions enrolled 108,000 persons. In 1941-42, 450,000 trainees were given instruction at 196 colleges and universities.

The safety clerk has telephone contact with the guards in towers on the plant grounds and at posts in the buildings

Guards for a War Plant

BY ARTHUR A. AGOSTINI, SAFETY SUPERVISOR, KEARNEY & TRECKER CORPORATION

An anti-sabotage guard for a war production plant requires hand-picked, well-trained men

AFTER PEARL HARBOR the Kearney & Trecker Corporation was confronted with the problem of converting its small organization of safety men into a large streamlined unit of industrial guards. The Safety Director's orders were to "protect the plant and its workers against possible sabotage in its many forms without interruption or antagonism to production."

To accomplish this additional men were added as fast as they could be trained. Men who had been with the company as long as ten years were assigned to the task of training the rookies. Within a short time an educational program was set up for old and new men alike to qualify them for the high standards set for future safety men to be employed.

Today the safety division employs nearly one hundred trained men and is considered one of the best anti-sabotage guard units in the country.

The safety men's duties are threefold: first, guarding the plant and employees against any form of sabotage; second, organizing fire brigades, first aid units, auxiliary police, demolition squads, air raid wardens, and voluntary safety men; third, promoting new safety programs and enforcing all safety regulations.

Guards attend a well-supervised class in gymnasium work dealing with calisthenics, running, marching, boxing, wrestling and jiujitsu. This together with a scheduled competitive sports program insures good physical condition and the necessary agility for a man to be a qualified guard.

As a group they attend the American National Red Cross classes in first aid. Many of them hold a certificate showing that they have fulfilled the requirements of the standard course in first aid work. Picked workers that compose the auxiliary units attend these same

classes. These classes will continue for the benefit of all employees who show a desire to take the course.

Under fire department supervision, the safety guards and their auxiliary brigades of plant workers attend a course in fire fighting. This course differs from many others of the same type inasmuch as it offers not only a theoretical training but a practical training equal to that given every city fireman. Members of this class, under the supervision of trained firemen, learn to handle the fire equipment under the same conditions that they would use in case of an actual fire. That the course has value and that the students have acquired training is attested by the professional way the guards and fire brigades have handled all fires that have broken out in the plant.

Rifle and pistol range practice plays an important part in the educational program. This class is supervised by the police department and several of the guards have been developed into expert marksmen. Each guard shoots a hundred rounds of ammunition each week until he is able to shoot seven bull's eyes out of ten at a 50-ft. range.

The organization and equipment of the safety division's guard is semi-military in character and follows the basic outline of a small military unit. This uniformed unit is made up of three patrols and works over a period covering 24 hours, week ends and holidays included. Each patrol is commanded by a lieutenant (or supervisor) who is directly accountable to the safety director. His immediate subordinates are his patrol sergeant and clerk. The sergeant remains at the main gate and supervises the hourly routine of change of guards by checking reports against his assignment schedule. In addition to this he supervises the identification of all persons passing through the gate. The clerk, in addition to regular clerical work, handles the switchboard that communicates with all posts and towers. Two orderlies (or inside patrolmen) are responsible for the checking of fire equipment and the general observance of safety measures employed in the plant. The outside patrol guard is located in one of the twelve strategically placed gates or towers surrounding the plant area. Each post is equipped with a cal. 0.30 Winchester carbine, a direct line of communication with the main gate and facilities for lighting or blacking out the immediate area. In addition the elevated towers are equipped with a powerful searchlight that is controlled by the guard in the tower.

Every hour a complete round of the plant is made for the purpose of plant inspection, punching both ADT and Detex clocks. During these rounds a careful check is made of the automatic sprinkling system including each riser and post indicator as well as the other fire equipment. By a rotating system departments are marked off into districts and the guard pays particular attention to the safety and fire hazards in the district assigned to him during this period. He also enforces all safety rules. All of the fire equipment in the plant is thoroughly inspected as to its workability, contents and location during each shift by three different groups —the roundsmen, the two orderlies and the voluntary fire brigade.

A badge system of identification is controlled by the safety division and every person on entering or leaving the plant is required to show his badge. A new employee is escorted by a safety man to the department, immediately following his medical examination. Here he is photographed and fingerprinted. His fingerprints and citizenship papers are made in duplicate. One is kept for the division's files and the other is mailed to the FBI. His photograph is taken against a measurement chart and is made into an identification badge. This badge has a color combination which denotes areas and departments its wearer is entitled to enter. The worker's plant number is put on the right of the photo and his shift number is put on the left. His plant number giving his department is put below his photograph. As an employee enters or leaves the plant during working hours, a record as to the time of arrival and departure is kept by the safety guard at the point of entrance.

Visitors and drivers of trucks are issued a special badge or pass upon proper identification and signature and are escorted to their proper destination by a guard.

While much stress is placed on plant protection against subversive activities, the original purpose of the safety division is, as its name implies, not forgotten. Production delays due to carelessness and resultant injury are of the same effect as sabotage and are as carefully guarded against. The company in addition to its modern safety installations has laid down a program to sell the idea of wearing safety goggles, shoes, and special protective devices. It is the safety division's assignment and duty to see that this equipment is in constant use during working hours. The Kearney & Trecker Corporation's record of safety is a testimonial as to how well this job has been done.

A series of lessons for the education of these safety men has been drawn up and are used in the form of a "lesson of the week." The intention and object of these lessons is to round out the safety men's knowledge and understanding of investigation, promotion of activities and psychology of organizing.

Part of the third shift of the safety division lines up outside the plant. Organization of the patrol is similar to that of a military unit

IDEAS FROM PRACTICAL MEN

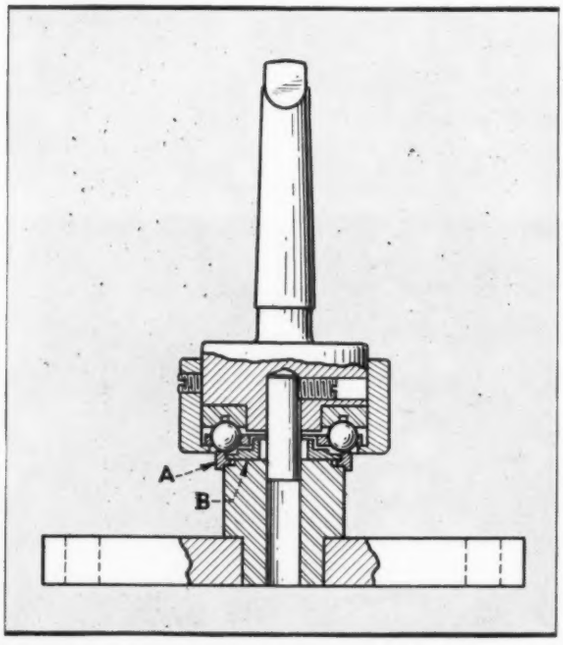
Spinning Tool Uses Ball Bearings

BY JOHN H. BURKAM

Spinning tools are ordinarily provided with rollers mounted on pins, which construction requires careful workmanship and often does not hold up well with continuous use. The spinning tool shown in the drawing is provided with hardened bearing balls taken from stock.

The two pieces *A* and *B* are to be fastened together by spinning. A base that will hold the parts is centrally located under the spindle of a drill press and securely attached to the drill press table.

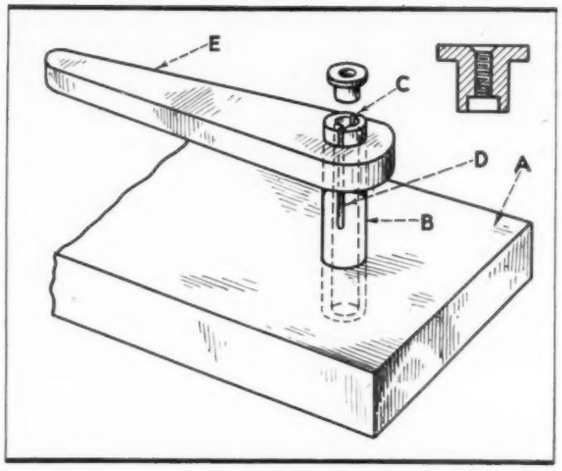
The tool has a pilot fastened in the end by a setscrew. This is essential for setting up purposes. A ball race made from hardened and ground tool steel is fitted to the end of the tool shank. The balls are



This spinning tool is built to use hardened bearing rolls which can be taken from stock

held in place against the ball race by a retaining ring. This ring has four holes arranged so that either two or three balls may be used, depending upon the kind of metal to be worked. An outer case is fitted over the tool and holds the retaining ring in position. This can easily be renewed by loosening a setscrew and the bearing balls can then be changed.

In operation the work is placed upon the base and the spinning tool lowered. The balls form a flange on part *A* which fastens part *B* in position. No lubrication is required.



Small part *D* is held in the jig for countersinking by depressing the end of lever *E*

Jig for Countersinking Small Parts

BY D. BAKER

Recently faced with the problem of putting a countersink in 10,000 parts, we built the quick-operating jig shown in the drawing.

Base *A* is made from cold-rolled steel plate. Drill rod *B* has hole *C* drilled all the way through the rod of the same size as the body of part *D* which is to be countersunk.

This rod is split about halfway down by a lengthwise saw cut which is slightly off center so that one side will be more rigid than the other. After hardening and drawing to a spring temper it is driven into a hole in base *A*. Handle *E* made from cold rolled steel with a hole that forms a slip fit over the rod is then placed in position.

With this jig clamped to the drill press table under the spindle it is a simple matter to insert the part in the split rod. Depressing the end of the lever provides a strong clamping action.

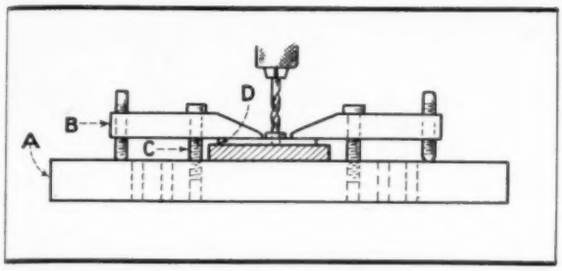
Parallel Clamps for Drilling

BY BEN FRANTZREB

Work can be conveniently clamped in place for drilling, or other operations by the parallel clamps shown in the drawing. Two parallel bars *A* are each fitted with two clamps *B*.

The clamps are fitted with two screws one of which rests on the bar while the other fits a threaded hole in the bar. Several of these holes can be included to provide for various springs between the clamps.

Work *C* is placed across the bars and clamped in



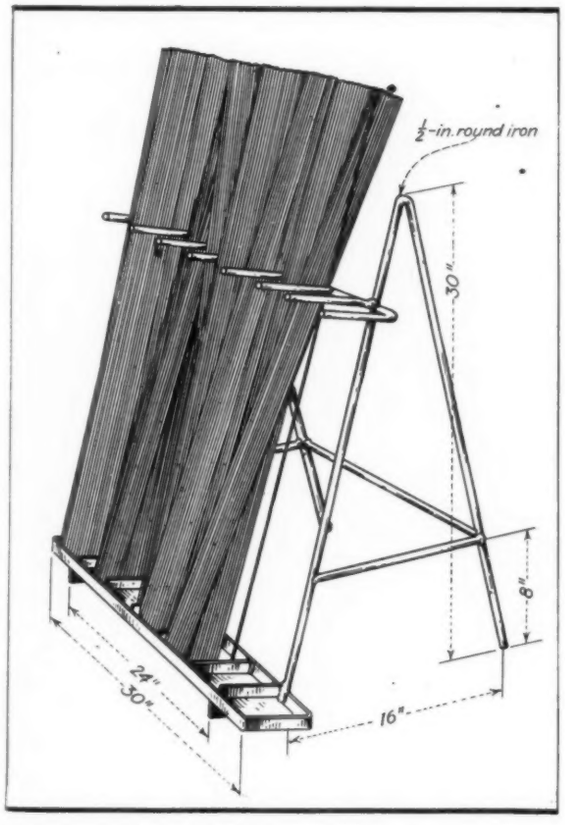
These clamps can be set in different holes in the bar to accommodate work of varying sizes

place by tightening the screws. In the drawing a drilling templet *D* is clamped to the top of the work. This clamping arrangement gives ample clearance around the drill and chuck.

A Rack for Welding Rod

BY ARTHUR HAVENS

Not infrequently welders must keep an exceptionally large supply of rod at hand, either for certain types of jobs like welding locomotive frames, or because it is more convenient to have such a supply at the welding bench. When these conditions exist, some means of keeping the rods in neat and handy order must be used. The illustrated rack serves this purpose.



This all welded rack will accommodate seven types of welding rod, with each till holding about 100 lb. of ¼-in. rod

The all-welded rack is made from ½-in. rod. A piece of $\frac{3}{16}$-in. plate 4½ in. wide and 30 in. long with a piece of ⅛x1-in. band iron welded all around forms the base or bottom rod holder. This is divided into seven compartments with short pieces of ⅛x1-in. iron welded in place. This bottom piece is welded to the front legs of the A-frames, using gussets of ¼-in. plate.

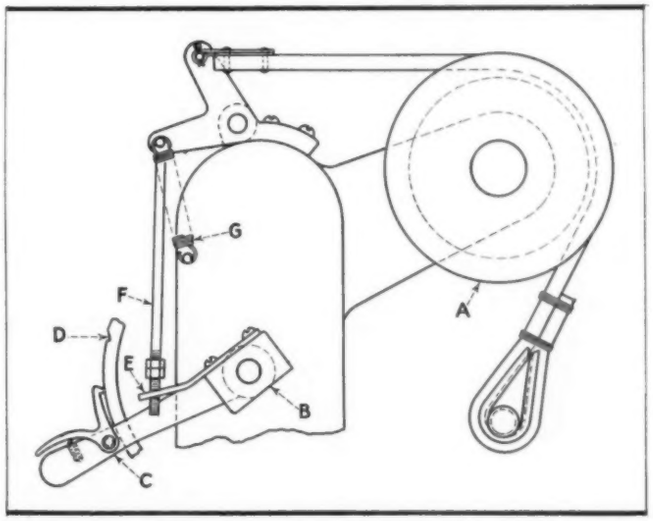
The welding rod tills are made by taking six pieces of ½-in. round stock, 5 in. long and welding them to a piece of ½-in. round stock cut 40 in. long, 5 in. at each end of which is later bent at 90 deg. When this is completed the assembled till is welded to the A-frames.

Belt Used in Self-Energizing Brake

BY JOHN F. CAVANAGH

In operating clutch-controlled machinery it is frequently necessary to apply a brake at the same time the clutch is released. By a simple mechanism a section of V-belt can be used as a self-energizing brake.

Mounted on the drive shaft is V-belt sheave *A*.



A powerful self-energizing braking action is provided by the V-belt, action of which is synchronized with the clutch by a single connecting arrangement

Clutch control shaft *B* is manually actuated by lever *C*, which has a conventional latch to engage notch *D* when the clutch is in operating position. Mounted upon lever *C* is short lever *E* which has a hole drilled in the end to fit loosely over connector *F*.

This connector is attached to one arm of a bell crank, the other arm of which is attached to a short length of V-belt which passes over sheave *A* and is anchored to a stud. A satisfactory way is by using a standard size thimble and binding the overlapped ends with a few strands of wire. Spring *G* is arranged to pull the V-belt into the sheave groove. Adjustment is provided by two nuts on the connector.

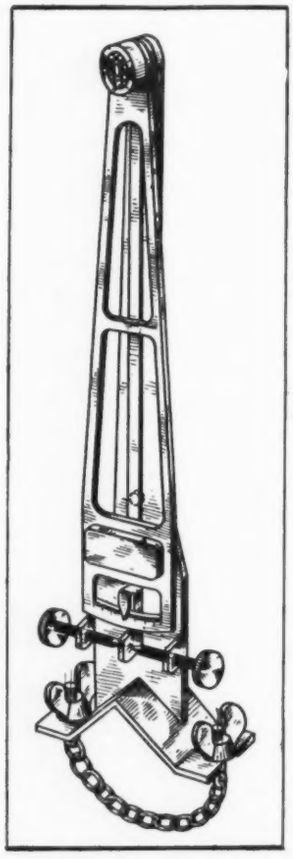
When the machine is started the bell crank will operate to slacken the V-belt. Because of the latter's

stiffness it will actually be pushed free of the sheave.

When the latch is released the spring will tighten the V-belt and a strong braking action will result. This arrangement is for a drive shaft rotating as indicated by the arrow. If the shaft were rotating in the other direction it would be necessary to anchor the belt at the upper end.

Fixture for Milling Keyseats in Line

BY E. L. LOFTIN



Keyseats can be milled in line on a long shaft by attaching this pendulum to the shaft and adjusting the pointer to zero

Milling keyseats in line on a long shaft can be a tedious and uncertain job without the aid of a special fixture. The attachment shown in the drawing has proved to be simple and accurate in operation.

The shaft is placed in position for milling the keyseats and the fixture is fastened in place by a chain clamp. The thumbscrews are used to connect the pointer to zero. The shaft may then be moved as desired and as many keyseats milled as may be needed, providing the fixture is not disturbed and the scale is brought to zero each time before milling begins.

The base is made from a piece of $\frac{1}{8}$-in. steel sheet to which the upright is welded. From the pivot is suspended a pointer, which can be adjusted by the thumbscrews at the bottom. From a ball bearing pivot at the top is suspended a pendulum made of 26 gage brass. A lead weight is attached at the lower end to increase the weight of the pendulum. A scale is marked across the lower end. A small stud fastened to the upright behind the pointer arm holds the latter away from the pendulum scale.

Uses for Scrap Superheater Unit Bolts

BY ARTHUR LAWRENCE

It is an established custom on many railroads to flame cut nuts from bolts when removing superheater units. This is done because the nuts on the bolts will not turn off without heating and much strenuous labor. The 1-in. bolts are cut at the top of the superheater clamp, allowing it to drop down out of the way. This leaves a T-headed piece about 5 or 6 in. long hanging in the superheater header. These pieces are usually scrapped.

We have been rethreading these T-head bolts and using them to hold engine-truck binders and tender coupler carrier irons. In these places, the T-head is superior to a regular hexagon-head bolt which usually cannot be kept from turning. The T-head bolt seats itself and will not turn in a confined space.

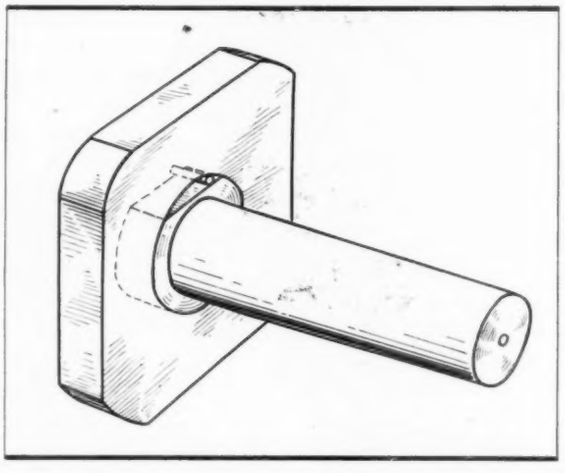
Roller Holds Work On Arbor

BY GEORGE HOLMAN

When work that must be turned in an arbor or mandrel is rough bored, a handy way to tighten the work is by means of a small roller. This should be from $\frac{1}{8}$ to $\frac{3}{16}$ in. in diameter. A flat is milled on the arbor, preferably on a collar. The work which fits securely on the arbor is slipped into place and the roller placed between the arbor and the work at the flat.

The work is turned until the flat is on the side away from the operator. This lets the roller fall into the proper position. A quick movement of the work will cause the key to seize. Care must be taken to prevent thrust of the work along the arbor.

Hardened drill rod on the shanks of broken drills make good roller keys. Where accurate alignment of the faces of the work is necessary, the work may be turned on a stub arbor, with a nut to hold it in place. This nut is not, however, to supplement the key.



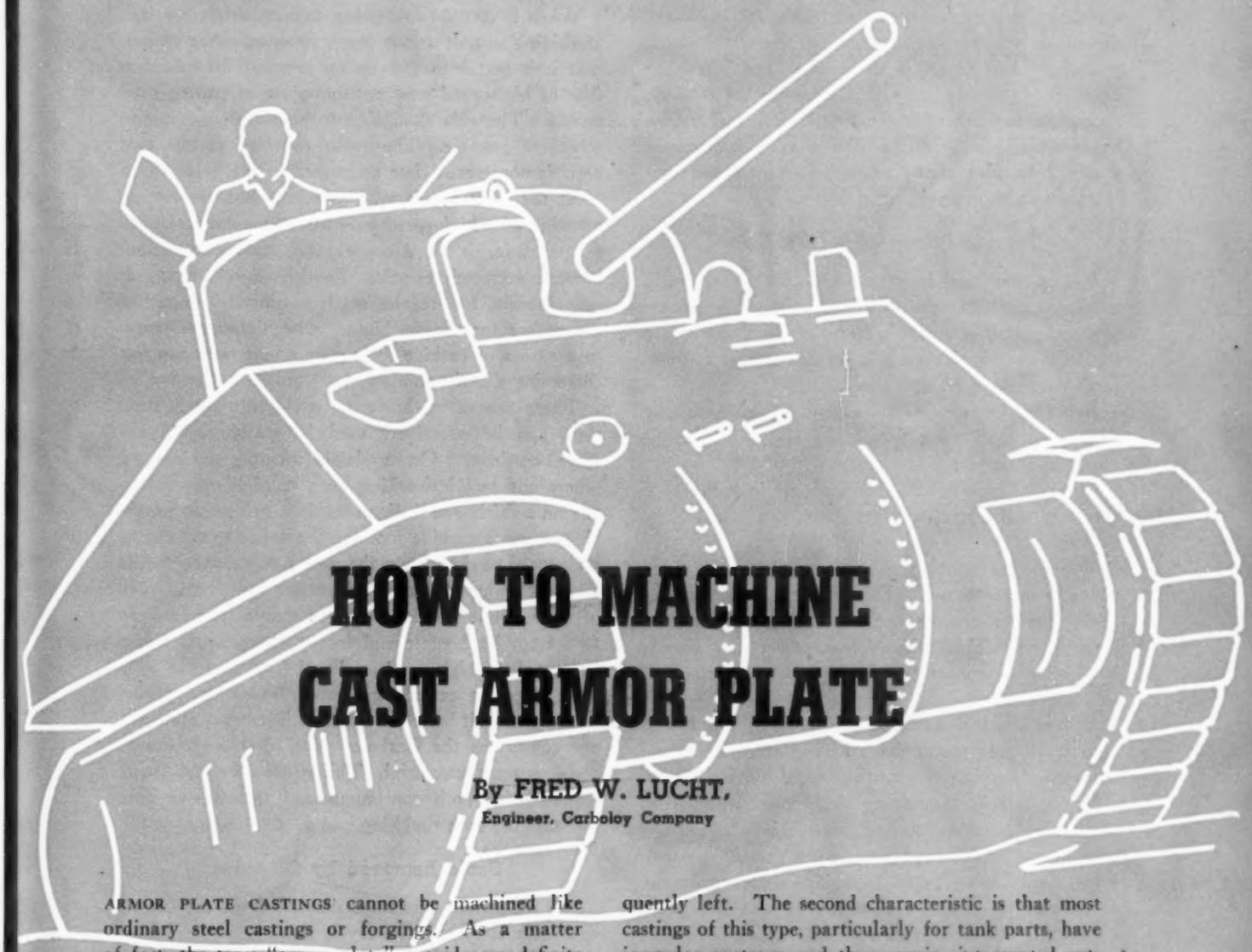
Rough-bored work can be held for turning by placing roller key between work and flat on the arbor

Recently this was used for turning gear blanks from 1-in. thick flat iron sheaves to squares. The roller pins held under the jolting when the workman knocked the corners off with cuts $\frac{1}{4}$-in. deep.

To remove the blank all that is required is a light blow with a hammer in the direction of rotation.

Armament

SECTION OF AMERICAN MACHINIST



HOW TO MACHINE CAST ARMOR PLATE

By FRED W. LUCHT,
Engineer, Carboloy Company

ARMOR PLATE CASTINGS cannot be machined like ordinary steel castings or forgings. As a matter of fact, the term "armor plate" provides no definite indication of itself as to the machineability or lack of machineability of an individual casting. The terms is a ballistic definition having only slight bearing on the chemical composition or physical characteristics of the material which actually determine its machineability. Castings which might be rated identical as to "armor plate" may have entirely different ranges of analyses and machining characteristics.

There are, however, a number of general considerations which apply to almost all armor plate castings requiring machining. It is the general practice, for instance, to remove the gates by flame cutting and an extremely hard glassy surface is frequently left. The second characteristic is that most castings of this type, particularly for tank parts, have irregular contours and thus require interrupted cutting. A third problem is that the casting is usually covered by a hard scale. Also, it is more usual than not to find hidden sand pockets and extremely hard inclusions present in the casting, particularly in the metal which has to be removed by machining.

An outstanding difficulty in machining armor plate is that this tough and hard material has a tendency to work harden. It is important to use tools which are as free cutting as possible. Another thing to remember is that while armor plate castings have heavier sections than those customarily found in ordinary steel castings, they flex more easily under pressure—returning to their original state when the pressure is released. This is an important considera-

This article has been reviewed and approved by the proper military authorities

tion in finish machining and also in relation to selection of depths of cut for roughing and finishing.

Equipment employed to machine armor plate castings consists largely of vertical boring mills, vertical turret lathes and large engine lathes. Prime characteristics required in such machines are that they should be sufficiently rugged to withstand the shock resulting from interrupted cutting, and that the drive motor should have ample power to pull the maximum number of tools—particularly when the latter are somewhat dull. The power requirements should take into consideration allowances for machining to maximum depth of cut.

Provide Power for Heavy Cuts

Horsepower requirements should be carefully checked to see that the machines will not be underpowered. If they are, it may be impossible to secure the combination of cutting speeds, depths of cut and feeds essential to efficient machining.

Best practice is to start with the actual machining to be done and work backwards for each machine using the formula:
Cutting horsepower = (depth of cut in inches) × (feed in inches) × (surface feet per minute) × (a constant).

For the constant in the formula, 10 is a good average value to use. To this of course must be added the horsepower required to operate the machine itself. This friction horsepower can usually be figured as approximately 30 percent of the cutting horsepower.

If possible, each machine should be equipped with a variable-speed motor drive having rheostat control to permit varying the cutting speed during a cut. This is a help in maintaining the proper cutting speed for facing cuts on rotating parts. It also permits smooth and rapid speed changing to protect the tools when hard spots or sand inclusions are encountered. Otherwise it might be necessary to run the entire cut at a lower speed, sacrificing machining time.

Fixtures should be sufficiently rugged to absorb the vibration and shock resulting from an interrupted cut. Points of location and support should be carefully selected to equalize stock removal, taking into account not only the particular operation in question, but also stock removal in subsequent operations. In machining armor plate castings it is highly desirable, if not essential, to precede fixture design by "planned cutting" layouts for each casting. If the distance between points of location and points of support in the fixture is relatively large, it may be necessary to provide a sufficient number of additional locking spring plungers or similar devices to furnish adequate support to the part.

Each fixture should also be provided with pads to enable rapid setting of tools to the size of cut desired. It is advisable that the pad location be based on using a thickness piece of definite size as a feeler rather than bringing the tool tip to the pad. Incidentally, this also avoids marring of the pad.

When it comes to selecting tool materials for the machining of cast armor plate, experience has shown that it is better to tool up on the basis of carbides than of high-speed steel or other types of cutting materials. The rule should be to plan to use carbides wherever possible. The value of this practice has been demonstrated time and again in the field.

At the slow speeds with which it is necessary to machine with high-speed steel tools (around 25 to 30 ft. per min. is an average maximum) production becomes extremely erratic. Tools have to be changed continuously for regrinding, resulting in excessive down-time for the machines. The higher resistance to abrasion of carbide tools goes a long way toward correcting this situation.

There are times, however, when high-speed steel tools can be effectively used in machining armor plate castings. On multiple turning operations where one tool is working on a large diameter and one on a fairly small diameter, it is sometimes advisable to use a carbide tool for the faster speed and a high-speed steel tool for the necessarily slower speed, thus obtaining maximum advantage from both types of tools. The smaller diameter should be relatively free from hard spots and inclusions to avoid rapid failure of the high-speed steel tool.

In selecting carbide grades for machining armor plate castings it has been our experience that for average conditions the Carboloy No. 78-B type of material is most successful. This grade seems to stand up well for both continuous and interrupted cuts and also for both roughing and finishing work.

Scale Removed by Carbides

An incidental advantage derived from the use of carbide tools which, however, is quite important as far as reducing machining time is concerned, is that parts can be cast closer to size. This is due to the ability of carbide tools to finish cut through scale more effectively than can be done with other materials. Reducing the amount of stock to be removed also saves vital material. As processing of armor plate castings becomes more commonplace, foundries will undoubtedly produce castings by improved methods closer to size, without leaving too much sand and other materials pocketed in the unmachined portion to reduce tool life.

Every machining operation on cast armor plate requires some definite tool shape and grind to produce the best finish on the work and to give longer tool life. On all cutting tools, the combination of

side cutting edge angle and the back and side rake angles has a direct bearing on tool life, since these three angles control the amount of protection afforded the cutting edge and the nose radius. The latter is usually the weakest portion of any carbide cutting tool and must receive maximum protection.

A general requisite to be remembered in applying carbide tools to interrupted cutting operations is to build up sufficient back pressure through the design of the cutting tool to prevent the tool from digging into the cut in any direction and also to absorb backlash in the machine before the nose radius on the tool enters the cut. Failure to observe this simple consideration may be the cause of much unnecessary tool trouble.

The dimensions of carbide tips to be used on cutting tools for cast armor plate may vary considerably, depending on the individual operation. In general, tips for tools to be used on interrupted cuts should be somewhat thicker than those used for continuous cuts, to withstand the repeated impact loads. Charts which will aid in the determination of tip thickness for this class of work have been compiled and are readily available. Tips should preferably not exceed one-third of the shank height in order to provide ample support under the tip. If the tip is exceptionally wide in relation to the width of the shank, it is frequently advisable to mill off the entire front of the tool and braze the tip onto the flat surface, rather than to attempt to set it into a recess, one side of which may be too thin to be of any use in providing adequate support.

Shank materials may be either SAE 9250 steel (Silman), carbon varieties ranging between SAE 1050 and SAE 1095, SAE 2340, or any low alloy type. Experience so far has shown that Carboloy standard shank steel is as well adapted to the machining of cast armor plate as anything we have been able to uncover.

The cross-section of the shank for any single point tool should be sufficiently large to withstand the bending load resulting from the depth of cut and feed used for a given tool overhang. When the cut is of an interrupted nature either use a larger shank or reduce the tool overhang, enabling the tool to withstand the increased impact load.

General indications are, for machining armor plate castings, that the use of the side cutting edge angle on carbide tipped tools protects the nose radius and for that reason tends to increase the tool life. This angle usually varies from zero to 30 deg. We suggest starting with 15 deg.

When the work calls for a continuous cut, a side cutting edge angle of from 5 to 20 deg. enables the load to be taken on the tip at a point well back from the nose where the tool is stronger. Sometimes the

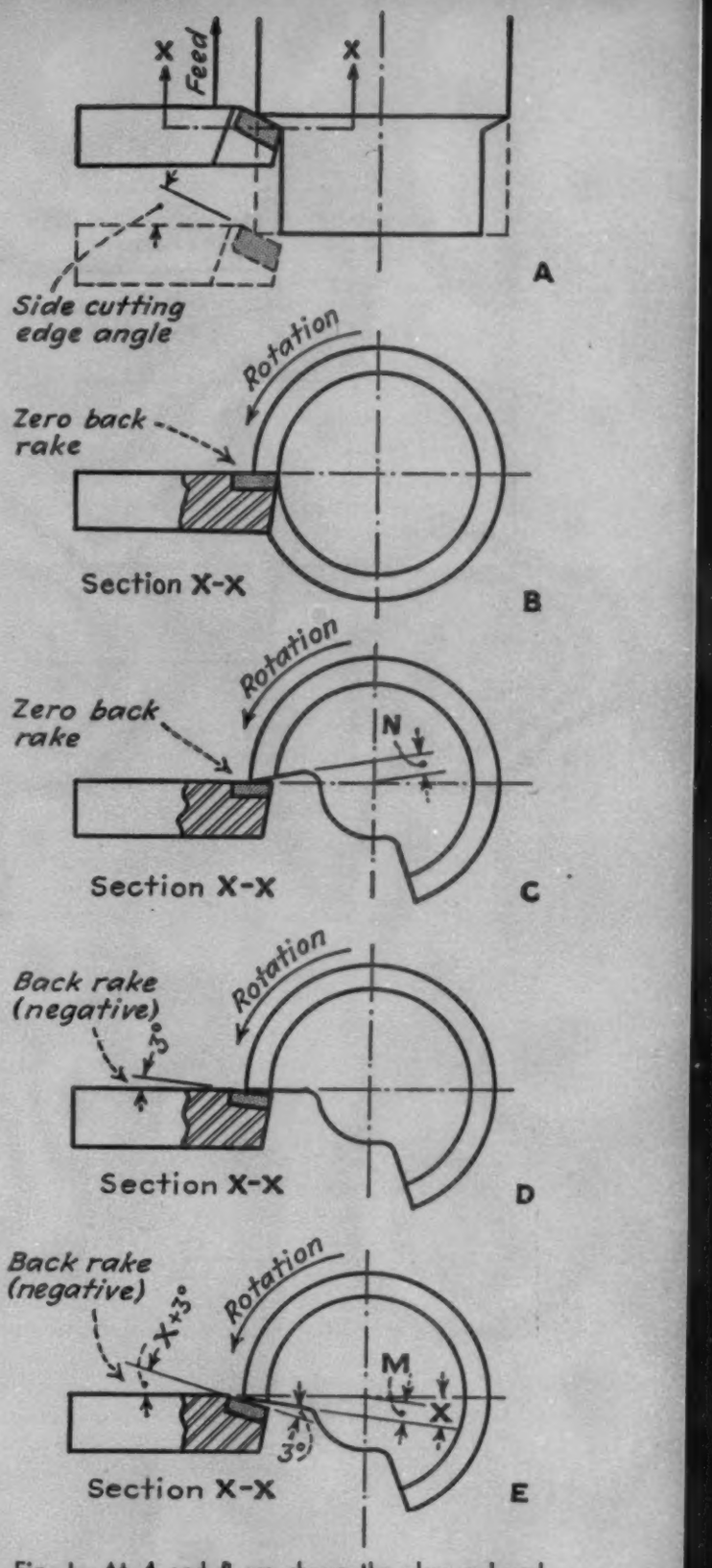


Fig. 1—At *A* and *B* are shown the plan and end views of a typical set-up for a continuous cut. In interrupted cuts where the face of the interruption slopes behind the center of the work, as at C, a 0-deg. back rake angle is preferable. If the face of the interruption is radial, a 3-deg. negative back rake usually gives best results. Such a case is shown at *D*. In cases where the face of the interruption slopes in front of the centerline of the work, as at *E*, the negative back rake angle is increased to give an effective 3-deg. angle between the top of the tool and the face of the interruption

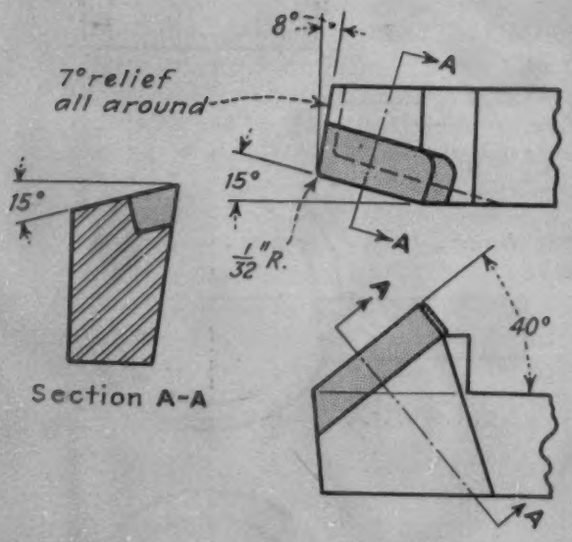


Fig. 2—The "shear" type tipped tool has been found suitable for rough machining armor plate castings, particularly where interrupted cuts must be taken. They also are suitable for roughing cuts on other large castings

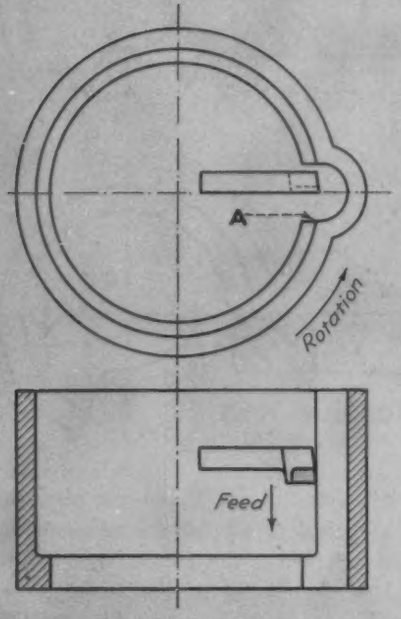


Fig. 3—When taking roughing or finishing cuts up to a shoulder, whether turning, facing or boring, and a 0-deg. side cutting edge angle must be used, negative back and side rake angles may be employed to increase tool life

smaller 5 deg. angle may be used for taking a roughing cut. This is advantageous when working up to a shoulder since it leaves a decreased amount of stock to be removed in the finishing cut. However, if the work is impregnated with hard inclusions and sand pockets, and particularly if it has an irregular outline, increasing the angle to 20 deg. provides a tool life sufficiently greater to more than compensate for the slight increase in the amount of stock to be removed in finishing. As a matter of fact, on many interrupted roughing cuts it is advisable to increase the side cutting edge angle to somewhere between 20 and 30 deg.

Increasing the side cutting edge angle also increases the end pressure on the tool. Where such end pressure must be held to a minimum in order, for instance, to avoid deflections in castings, a 0-deg. side cutting edge angle tool is usually most suitable. This also has the advantage of making the tool freer cutting and reducing the amount of power required to operate the machine. It is necessary to balance the tool life obtained from large side cutting edge angles with the freer cutting action of small values for this angle. A good general rule is to lean toward the large angles for interrupted cuts and smaller values for continuous cuts.

After the best side cutting edge angle has been established, its relationship to the side of the tool shank should be maintained in service within about $\pm$ 2 deg. (unless a closer tolerance is necessary on the part in question). This much variation will not change the cutting action of the tool sufficiently to cause tool trouble.

On carbide tools to be used for machining armor plate, correct back rake is important. This is due mainly to the fact that most machining operations are of the interrupted type. Here the use of negative back rake has been found highly advantageous in many applications. Tools with negative back rakes enter the cut after an interruption in such a manner that the impact load is considerably reduced and initially falls farther back on the tool where strength is greater. The tool then enters the cut with a "shaving" action which also helps the nose of the tool since the latter will be eased into the cut with minimum impact.

When such shear type tools with negative back rake are used, the tip of the tool is below center. This provides another advantage in that it reduces the amount of front clearance necessary and thereby strengthens the tool by providing more shank support under the nose.

This type of tool is illustrated in Fig. 1, which shows the effect of back rake in taking different types of cuts. At *A* and *B* are shown the plan and end views of a set-up for a continuous-type cut in

which 0 deg. back rake is desirable. To insure that the nose radius of the tool is following the balance of the side cutting edge in entering the cut, a side cutting edge angle is provided on the tool as shown in *A*. This takes care of the single entry of the tool into the cut required for this type of operation. Once the nose radius of the tool is buried in the cut, there is no further tendency for it to break down except through customary wear.

On continuous cuts where there are considerable hard inclusions or sand pockets it is preferable to provide the tool with a small negative back rake of the general design as shown in Fig. 1-*D*. Usually a 3 deg. effective negative back rake will sufficiently reduce the tendency for the nose radius to dig into the work as it passes hard spots and sand holes. It will also maintain the backlash in the machine in a constant direction.

Figs. 1-*C* and 1-*E* show how an effective negative back rake of 3 deg. is provided in the tool under other conditions. In 1-*C* the face of the interruption on the work, approaching the tool, slopes behind the center of the work by some amount *N*. Here a 0-deg. back rake is preferable for maximum tool life. The tool takes the impact load of the work nearer the back end of the carbide blank while the pressure of the sloping surface of the face of the interruption on the work, taken along the side cutting edge angle, maintains machine backlash in a constant direction. It also retards any tendency for the nose radius on the tool to dig into the work at the beginning of each cut.

When the face of the interruption on the work is negative as shown in Fig. 1-*E* the amount of negative back rake will have to be increased in proportion to the slope of the face, still leaving an effective 3-deg. angle between the top of the tool and the face of the interruption. Sometimes this means that the negative back rack angle will be as high as 35 to 50 deg. While this may seem excessive, free cutting action for the tool will be retained as long as the side rake angle is increased to a sufficient amount, usually 10 to 25 deg.

When the face of the interruption on a casting includes several of the conditions shown in Figs. 1-*C* to 1-*E*, the tools should be made with a back rake which will cover the most difficult condition.

Shear Tools for Castings

The type of tool under discussion is shown in Fig. 2 and is known as a "shear" tool. While this type of tool has been used quite extensively in the past, it had fallen into disuse until recently. Reintroduced in several shops by Carboloy, it is doing a real job in rough machining on interrupted cuts not only for armor plate but on other forms of large castings. It is not as useful for finishing cuts because the chip is curled toward the finished surface and has a tendency to mar the finish. General design of the tool limits its use to shanks approximately 1-in. square or larger.

General indications are that when interrupted cuts are taken on armor plate castings, a side rake angle of between 5-deg. positive and 3-deg. negative provides best tool life. The larger positive side rake improves free cutting action. If the cut is continuous, it is best to start with a 5-deg. positive side rake. When the surface of the work is hard and scaly and contains hard inclusions and sand pockets, the side rake may be reduced to zero or even 3-deg. negative in order to reduce the tendency to chip the side cutting edge and thereby reducing tool life. This applies to continuous as well as interrupted cuts.

Negative Side Rake Seldom Used

On tools with a large side cutting edge angle and a negative back rake, negative side rake should never be added unless it becomes absolutely essential for tool life, since a negative side rake under such conditions retards the free cutting action of the tool. The double negative rake angles on such tools also become objectionable at times because of the added strain they place on both machine and fixture. When it is necessary to mount a tool with considerable overhang as sometimes occurs in boring mills, tools with double negative rake angles frequently limit the possible machine speed and feed due to this condition.

An exception to the objection to double negative rake angles is illustrated in Fig. 3. This may occur quite frequently in rough or finish turning, facing, or boring interrupted cuts up to a shoulder. Under such conditions tool requirements call for a 0-deg. side cutting edge angle and here the double negative rake angles may be used to increase tool life and facilitate holding to tolerances. In such an application a tool has a tendency, during the entire length of the cut, to move outward in the direction of the nose radius whenever the open space in the cut passes the tool. Here the tool may be given a 3-deg. negative back rake to prevent it from being damaged under impact by the approach portion of the interruption *A*. When this tool reaches a shoulder at the end of the cut, it has a tendency to move in the direction of the feed when the open space in the cut passes the tool. To prevent the tool from being damaged under these conditions as well, the face of the tool should also have a 3-deg. negative side rake.

The end cutting edge angle may vary between 8 and 30 deg. We suggest starting with 8 deg. In general, it is desirable to hold the end cutting edge angle down as low as possible to give maximum strength to the nose of the tool. For continuous

cutting in fairly clean armor plate castings this angle may range between 8 and 15 deg. for ordinary turning, facing and boring operations. Where castings are impregnated with either hard inclusions or sand pockets or if the cut has interruptions in it, the minimum value (8 deg.) should be used for the cutting edge angle to provide maximum support for the nose radius.

In multiple tool turning where it is necessary that the tools must plunge in at the start of the cut, it should be remembered that the compound feed angle is added to the end cutting edge angle and must be provided for in the design of the tool. When it becomes necessary to feed the tool gradually into the cut and then feed it longitudinally during a turning operation, the end cutting edge angle may have to be increased to 30 deg. to provide proper clearance depending on the cam movement. If the cam movement is gradual, the angle can be made smaller. The tool angle should be at least 8 deg. greater than that of the cam, however.

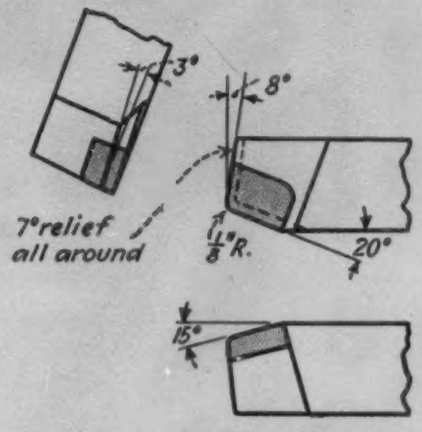


Fig. 4—When a tool of this type is employed for removing 1/32 to 1/16 in. of stock on a side for an intermittent finishing cut in a lathe it will be found that the end dulls rapidly. The cutting action will be improved if the nose is chamfered, as in Fig. 5, instead of using a 1/8-in. nose radius

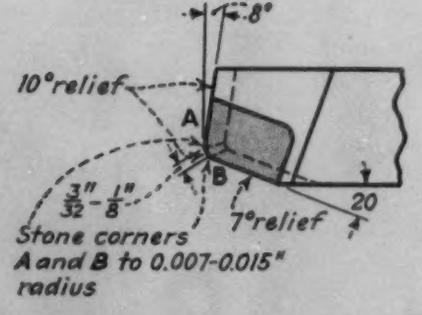


Fig. 5—A 45-deg. chamfer on the nose of a finish turning tool gives better results in intermittent cuts than if a radius is ground on the nose. The corners *A* and *B* should be honed to a 0.007-0.015 in. radius

A prime consideration in designing carbide tools is to use a small nose radius, well supported. The smaller the radius, the more free cutting the tool. These considerations apply equally to all turning, facing or boring tools. If the nose radii are too large the increased pressure between the work and the tool may develop chatter. For continuous cuts we suggest starting with $\frac{1}{16}$-in. nose radius and for interrupted cuts start with $\frac{3}{32}$-in. radius and vary to suit conditions.

For continuous cutting in clean material a nose radius of $\frac{1}{32}$ to $\frac{1}{16}$ in. is recommended. Where the work contains hard inclusions or sand pockets or if the cut has interruptions in it, a larger nose radius may be necessary to strengthen the tool to resist the resulting impact load. Under such conditions it may be necessary to increase the nose radius to as much as $\frac{1}{8}$ in., but the latter size should never be exceeded unless absolutely necessary. Under interrupted cut conditions it would be preferable to use a shear type tool, as in Fig. 2, to reduce the impact load on the radius rather than increase its size. The smaller nose radii also generate less heat.

If a large nose radius is required because of the design of the part, as in cutting up to a curved portion or fillet, maximum tool life is obtained if the necessary rough and finish cuts do not include the finishing of the larger radius. The latter can be formed as a separate operation with an extra tool permitting retention of the small nose radii for the roughing and finishing tools. The extra operation involved is usually more than compensated for by the greater life of the tool and reduced tool changes necessary.

Sometimes it is necessary to use a tool of the type shown in Fig. 4 on an engine lathe, not only to rough turn an intermittent cut, but also to remove $\frac{1}{32}$ to $\frac{1}{16}$ in. of stock on a side for a finishing cut. When this is done it is sometimes noticed that the end of the tool dulls rapidly. This rapid dulling is caused by the wedging action from the intermittent cutting of the large nose radius on the shallow cut. A terrific impact load is placed on the machine, resulting in the necessity for reducing cutting speed and a general slowing up of the machining operation.

All phases of this operation can be improved if

instead of a $\frac{1}{8}$ in. nose radius, a chamfer as shown in Fig. 5 is used. This 45 deg. chamfer is from $\frac{3}{32}$ to $\frac{1}{8}$ in. wide. The relief angle on the chamfer and the 8 deg. end cutting edge angle should be increased to 10 deg. The entire cutting edge contacting the work should be honed to remove the feather edges left by grinding. The sharp corners *A* and *B* should also be honed to a radius of approximately 0.007 to 0.015 in.

With these changes a free cutting tool is provided having sufficient strength along the lead angle to withstand the impact load of the rough cut while the small nose radii are ideal for the shallow depth of the finish cut. The increased relief angle at the point *A* not only provides a freer cutting action but also retards the tendency toward rapid widening of the wear land, prevalent with small relief angles.

To obtain free cutting action, adequate relief must be provided below the cutting edge angle. In general, it has been found most satisfactory to use a 7 deg. relief around the side cutting edge, the nose radius and the end cutting edge of all single point tools used to machine armor plate castings. We suggest starting with 7 deg. relief angles on tools and increase them only if it will improve tool life.

This angle gives maximum support below the cutting edge while still providing a free cutting tool. Where shank cross sections are $\frac{3}{4}$ in. square or larger, the shank below the cutting edges should be rough ground to a 10 deg. secondary relief angle up to within $\frac{1}{16}$ in. of the cutting edge before grinding the 7 deg. relief angle.

The 7 deg. relief angle is satisfactory for boring tools but the secondary relief angle may be necessary around the cutting edge and the nose radius to prevent the heel of the tool from dragging on the finished cut. This is illustrated in Fig. 6. Here the secondary relief angle should be carried up to within about $\frac{1}{16}$ in. from the cutting edge, making certain that the secondary relief is carried around the nose radius. The amount of the secondary relief for boring tools is dependent on the diameter of the hole being bored and the shank thickness.

For facing, where the cut is taken from the inside out as shown in Fig. 7, the primary relief angle of 7 deg. should still be used, but here also it may be necessary to increase the secondary relief angle *C* around the side cutting edge angle and the nose radius to prevent the heel *D* of the tool from dragging. Here again the secondary relief should be carried to only within $\frac{1}{16}$ in. from the cutting edge. The amount of the secondary relief angle to be used is dependent on the minimum diameter of the facing cut and the shank thickness in the same manner as in the case of boring tools.

On single point tools used for machining armor plate castings chip breakers, in general, are undesirable. They should not be used unless the chip become a hazard to the operator or ruins the finish on the work or spoils the tool. Chip breakers reduce tool life because of the increase in the already high chip pressure on top of the cutting edge. Where chip control must be built into the tool, it is desirable to use a chip curler rather than a breaker. These curlers should be designed to coil the chip loosely. Free cutting action is also improved by use of a looser curler. Incidentally, hard spots tend to curl the

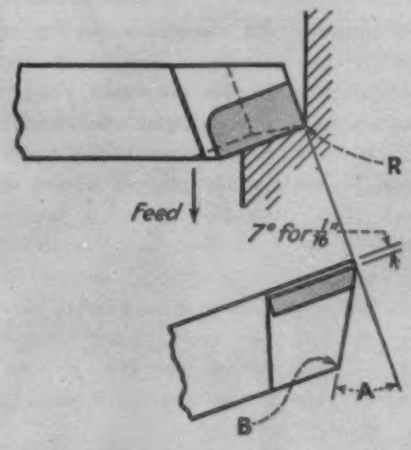


Fig. 6—Relief angles on all single point tools used to machine armor plate castings should be about 7 deg. However, for boring tools, a secondary relief or clearance angle *A* may be necessary to prevent the heel *B* from dragging on the work

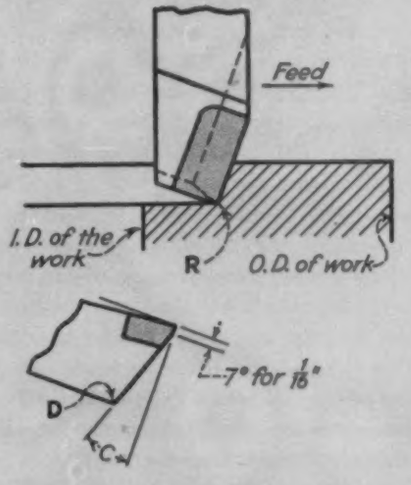


Fig. 7—Where a facing cut is taken from the inside out it will be necessary to grind a secondary relief angle *C* around the side cutting edge angle and the nose radius to prevent the heel *D* from dragging

chips tighter, another reason for loose normal curling.

Chips should never be broken into short lengths. A short chip may raise loads up to a point where the machine actually kicks out, stalls and breaks tools. It is rather remarkable to note the extent of this increase in loading. We have seen heavy machines stall where a lighter machine would take the same cut without difficulty just due to the use of a chip breaker which had a tendency to choke the chip.

On interrupted cuts chip breakers frequently can be forgotten entirely since no objectionable or dangerous hay-like chip is formed as may be the case with continuous cuts. If a chip curler is required for an interrupted cut to control the chip between interruptions, this curler should be of maximum width.

On continuous cuts on armor plate castings it is sometimes difficult to control the chip if the casting is in poor condition necessitating running at slow speeds. This type of chip is almost impossible to break. It is preferable to coil it loosely in coils of about $1\frac{1}{4}$ to $1\frac{1}{2}$ in. diameter. Usually when this is done one of three things will happen: The coil will eventually hit the work and break off; it will hit some part of the fixture, chuck jaws or chip bank and break off; or, it will drop because of its own weight. Many times a flow of coolant on the chip will simplify breaking it.

One of the hazards of coiling chips too tightly is that a high pressure is built up and when the chip snaps away from the cut it usually flies off at a rather high velocity, becoming a real danger to the operator or anyone else near the machine.

When negative rake angles (either back or side rake, or both) are used, there is a decreased tendency toward a chip problem since a tool so designed will direct the chip against the unformed portion of the cut and break it. If it fails to do so at one feed, proper chip breakage may be restored by increasing the feed slightly. Fig. 8 shows a number of designs of chip curlers to take care of different conditions. At *A* is shown a standard type of tool with a $\frac{1}{32}$ in. nose radius. Here a normal angular type chip curler is ground parallel with the face of the tool.

With a nose radius as large as $\frac{1}{8}$ in. as shown in *B*, other conditions being the same, the heel or shoulder *X* of the chip curler may touch the outside diameter of the finished cut *Y* of the work. Since this is the point of the tool which determines the size of the cut, interference here will cause rapid tool break-down and spoil the finish on the work.

To remedy this condition the curler should be reground to the previous depth and the angle increased as shown in *C*. The distance *M* remains the same as previously, but the distance *N* should be approximately $1\frac{1}{2}$ times the nose radius. Another method of correcting the condition is shown in *D*, in which a 60 deg. angle to the main chip curler is ground into the tool to make the dimension *N* about $1\frac{1}{2}$ times the nose radius.

If a chip curler has to be used it is highly important that the operator follow the tool prints for instructions in regrinding tools. Fig. 9 shows a carbide tipped tool with a chip curler which operated quite satisfactorily with the width *A* and depth *B* for the curler. When reground to sharpen the cutting edge angle *C* it failed to give as good life between grinds as previously. The operator, when he sharpened the tool, ground it on the relief angle *D* around the side cutting edge angle *C*, the end cutting edge angle *E* and the nose radius *R*. While grinding the chip curler surface *F* the operator followed the shoulder *G* and increased the depth *B* to clean up the cutting edge.

The reason for the decreased life of the tool after regrinding was that the narrower and deeper chip

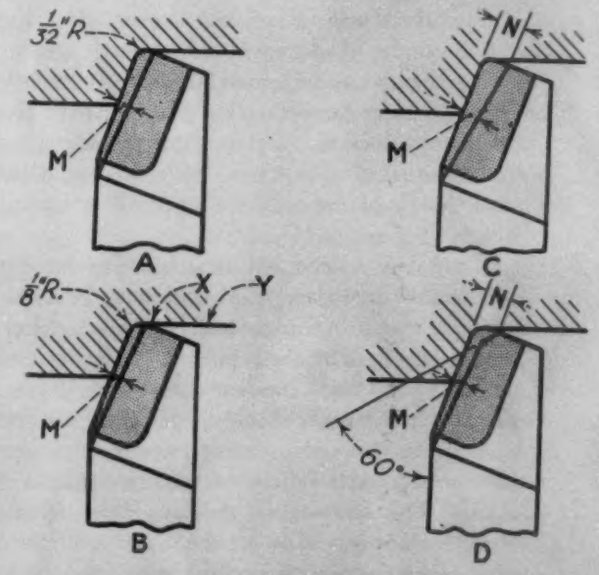


Fig. 8—In general, chip breakers are not desirable on single-point tools used for machining armor plate castings. Where chip control is needed, a chip curler, like those shown, is better than a chip breaker. At A is shown a normal angular-type chip curler ground parallel with the face of the tool. With such a curler, the shoulder *X* may touch the finished work, as at *B*, and result in rapid tool break-down. To remedy this condition, grind the curler as shown at *C*, with the distance *M* the same as in *B* but with the distance *N* 1½ times the nose radius. At *D* is shown another method of correcting the condition shown in *B*. *N* is about 1½ times the nose radius

curler which resulted from the last grinding operation choked the flow of the chips, built up excessive pressure, damaged the side cutting edge and decreased the tool life. Correct grinding procedure would have called for re-establishing the width *A* when cleaning up the curler surface *F* and then grinding the face *H* of the tool to maintain the previous depth *B*.

Another point to keep in mind, particularly in machining tough materials, is illustrated in Fig. 10. At *A* is shown an enlarged portion of a cemented carbide tipped tool after grinding a well proportioned ground-in chip curler with a well dressed and properly shaped diamond wheel *M*. The tool is still in the tilted position as when ground.

At *B* the same tool is shown in its natural position as it fits in its tool holder. The bottom surface of the chip curler makes the proper side rake angle *R* with the work. The fillet *X* in the corner of the shoulder should usually be held to a maximum radius of $\frac{1}{32}$ in. The upper edge of shoulder *Y* should also be broken with stone to prevent chipping. At *C* and *D* are shown on the other hand a portion of the same tool after grinding a chip curler with a diamond wheel *P* which was allowed to wear to practically a convex shaped outline.

Instead of the bottom surface of the chip curler making the correct side rake angle with the work it actually makes a negative side rake angle *N*. This angle is far from a free cutting angle and produces an increased pressure on the face of the tool. This causes the cutting edge to break down much faster, produces a poorer finish on the work and also requires more power to operate. The shoulder at the back of the curler now also has an exceptionally large fillet which will cause trouble in controlling the chip. This type of chip curler, when ground slightly deeper than it should be, has been known to actually stall a machine.

The above indicates the real importance of not

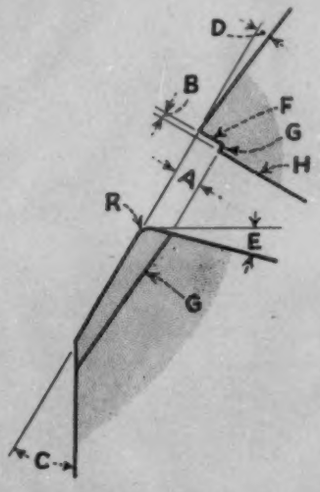


Fig. 9—When chip curlers are used, it is important that the dimensions of the curler step be maintained at all regrinds. Should the step be made narrower and deeper than originally specified, the flow of chips may be choked, resulting in excessive pressure that will damage the side cutting edge and decrease the life of the tool

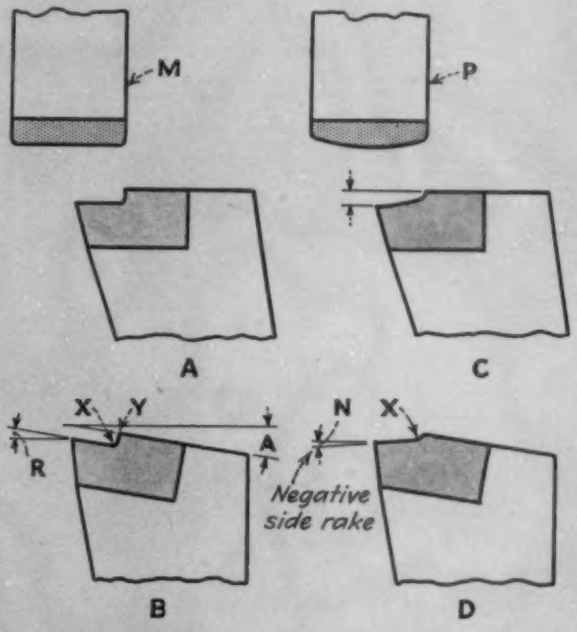
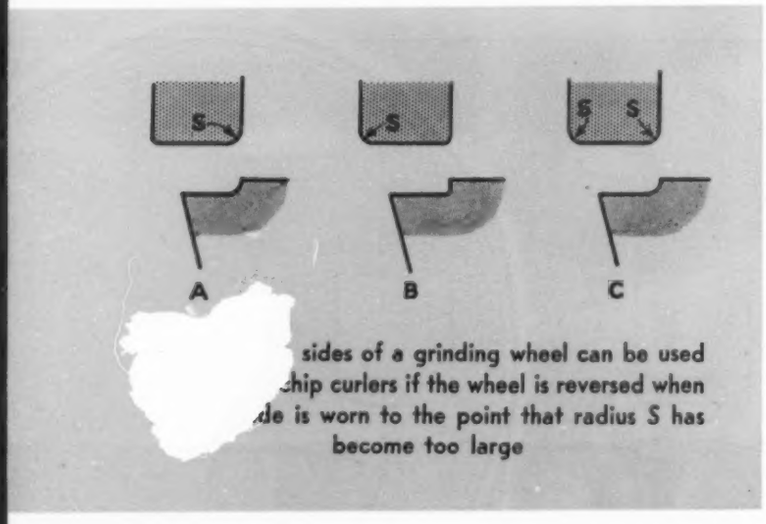


Fig. 10—It is important not to use dull and worn out diamond wheels for grinding chip curlers. The curler ground with a sharp wheel *M* as in *A* will provide the proper side rake angle with the work when the tool is clamped in the holder as in *B*. On the other hand, the curler ground with the dull wheel *P* shown in *C* makes a negative side rake angle with the work when in its normal position as shown in *D*. More power is required with such a tool, and the cutting edge breaks down rapidly

using worn out diamond wheels for grinding chip curlers. A good way to handle grinding wheels to avoid this difficulty is illustrated in Fig. 11. At *A* the radius *S* has become too large. The wheel is then reversed as in *B*. When the other side of the wheel has worn to a radius *S* as in *C*, the entire wheel should be dressed.

In setting up for machining cast armor plate care should be taken when clamping a part in the fixture to see that clamping pressures are not excessive. If they are, there is a chance that the casting will be distorted, especially if the fixture support is not directly opposite the clamp. This also applies to auxiliary support screws when used in place of locating spring plungers.

It is essential that tool overhang be kept down to the minimum, particularly on interrupted cuts. Sometimes the operator is forced to use a tool with too long a shank. This may cause excessive tool overhang for the shank size in question. The result may be that high frequency vibration will be set up in the shank to such an extent that while cutting, the tool will develop a singing sound or even chatter. This should be carefully avoided since it decreases tool life, and if it occurs tool length should be decreased a sufficient amount to reduce tool overhang to a minimum.



sides of a grinding wheel can be used hip curlers if the wheel is reversed when de is worn to the point that radius S has become too large

Care should be taken to clamp the tool in the holder in the same position each time, squaring the tool up from the sides of the slots in the tool holder.

If the tool has a shank height less than that for which the tool holder was designed, the cutting edge of the tool should be brought up to center by shimming underneath the shank. This shim should extend the full length of the tool shank to come as close underneath the cutting edge as possible. In the case of shear type tools, the shim should raise the tool to a position where the first contact between the tool and the work after each interruption is on the center line as shown in Fig. 1-*D*. If this involves difficulties, the best practice would be to shim the shear type tool so that the top of the shank is on the center line of the work. Usually this will be close enough to insure good performance.

Since tool holders are not interchangeable on right and left hand rams of vertical boring mills, care should be taken that the correct tool holder is mounted in each ram. Otherwise one tool will be too far ahead of center while the other will be too far behind center, resulting in tool trouble and breakage.

If set-up pads are provided on the fixture, care should be taken to see that the tool is not dropped against the pad or that the thickness piece is forced between tool and set-up pad. Either one may cause chipping of the cutting edge, resulting in rapid tool breakdown.

On many vertical boring mills, much valuable time is wasted by the operator taking cuts on a cut-and-try basis to bring an important diameter within specific tolerances after taking the initial roughing cut. This waste time can be materially reduced by providing the operator with an indicating type of gage, enabling him to quickly determine the amount he is off-size. By using graduated dials on the machine, he can then quickly make the necessary adjustment for size and take the final finishing cut.

Two different methods of procedure are recommended when a machine accidentally stops with the tool in the cut. If the tool is accessible or will not drop if loosened, disconnect the feed, loosen the clamp screws, remove the tool and examine it before starting the machine. If the tool is not accessible or will drop if loosened disconnect the feed before starting the machine.

As a matter of fact, whenever it is desired to stop a cut the *feed* should always be thrown out *first*, allowing the tool to free itself in the cut before the machine is stopped. When the cut is of the interrupted type, the operator moreover should try to stop the machine with the tool in an open space *after* throwing out the feed.

General indications are that longer tool life is obtained by cutting armor plate castings dry. It is frequently necessary, however, as on parts where accurate size is of prime importance, to use a coolant to prevent the casting from absorbing the heat of the roughing cut and thereby distorting the casting in the fixture. Coolant also sometimes should be used to prevent overheating of the work when finish machining due to the possibility of a dimension being to size while hot and then shrinking undersize when

it cools off. The loss of time resulting from the necessity of waiting for a casting to cool after rough machining is also a consideration in whether or not a coolant should be used.

If a coolant is used for this purpose, however, it should not be directed against the tool or allowed to splash against it, but should be directed whenever possible against some major portion of the casting to keep the work itself cool. Where limitations make it necessary to direct the coolant to a point on the casting near the tool, a high velocity stream of coolant should be used, directing it at both the face of the tool and the curling chip. A properly cooled chip will have a silver color. If coolant must be used, a solution of soluble oil as furnished by any of the leading cutting oil manufacturers is recommended.

In machining cast armor plate it is usually desirable to use as deep a cut as possible, compensating for extremely heavy depths of cut, if necessary, by using relatively light feeds. In roughing, best practice is to cut to within $\frac{1}{16}$ in. of the finished diameter or face, thus "sinking" the roughing tools as much as possible. Cuts as deep as $\frac{3}{4}$ or 1 in. have been taken effectively with Carboloy tools. As a matter of fact, carbide tools seem to stand up better with deep rather than light cuts. The reason for this is that the pressure is distributed over a greater length of the tip.

On interrupted cuts the advantage of burying the tool to the maximum depth of cut and reducing the feed if necessary is even greater than on continuous cuts. Tool life will be better under such conditions than if the depth of cut is equivalent to the nose radius or even less. The reason is that the shock of the interruption is removed from the nose end of the tool and first contact between the tool and the work after each interruption is located farther back toward the end of the tip where the strength is greater. When the tool hits a sand pocket or hard inclusion, a deep cut will insure the tool being buried in clean material to steady it while cutting. Furthermore, the tool will not be as free cutting if the nose radius or less is buried in the cut, as it will be if a greater portion of the side cutting angle is also cutting.

When roughing interrupted cuts it is important not to leave less than $\frac{1}{32}$ in. for finishing since the casting is distorted to some extent during the roughing cut. For interrupted cuts, best depth of cut for finishing is around $\frac{1}{32}$ to $\frac{1}{16}$ in.

As mentioned previously it is desirable to use less feed with a greater depth of cut rather than larger feed with a small depth of cut, if a choice is available. A most satisfactory feed usually is 0.010 to 0.025 in. per revolution, with a starting feed of 0.015 in. As a matter of fact, a feed of 0.015 in. per rev. is a good average to use in most cases, permitting the tool to penetrate the scaly surface, hidden hard spots and sand pockets while also easing the impact load resulting from these conditions and from most interrupted cutting.

At times it becomes desirable to reduce the feed to about 0.010 in. per rev. to decrease the impact load on the tool. This light feed, however, may at times tend to reduce the tool life because of the increased abrasive action of the light chip on the tool. With a light feed there is also an increase in the abrasive action between the tool and the work at the point of entry of the tool into the interrupted cut.

Both of these conditions may become aggravated if a tool with a large side cutting edge angle is used on a machine having a considerable amount of backlash. The following table shows the manner in which the chip thickness is affected by the side cutting edge angle for feeds of 0.010 and 0.015 in. respectively.

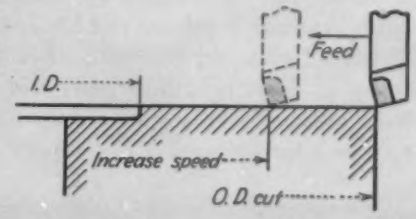


Fig. 12—By increasing table speed as the facing tool approaches the center of the work it is possible to improve machining conditions, increase tool life and reduce over-all machining time. Under-speeding will be indicated by poor finish and a sluggish type of chip

Side Cutting Edge Angle-Deg.	*Chip Thickness for Following Feeds-Inch*	
	0.010	*0.015*
0	0.0100	0.0150
15	0.0097	0.0145
30	0.0086	0.0130
45	0.0071	0.0106
60	0.0050	0.0075

The larger the cutting edge angle, the larger the feed should be in order to obtain maximum tool life. When machines are relatively free from backlash and maximum rigidity is available in the entire set-up, feeds as high as 0.020 to 0.025 in. per rev. can be used. The higher range of feeds (from 0.015 to 0.025 in. per rev.) tend to crush the scale and sand pockets much more effectively than when lighter feeds are used. When such higher feeds are permissible, tool life is increased.

Where size is not important, a feed of about 0.010 in. per rev. has the advantage that it will produce

an acceptable finish in one pass. In general, after the job is operating satisfactorily, the best procedure is to increase the feed slightly until the set of conditions is found which will give minimum machining time for the part in question while leaving the required degree of finish. On many parts it will be found that higher feeds may be used on finishing than on roughing cuts for the same machined portion, particularly those parts where fineness of finish is not too important.

These include parts which do not have an intimate fit with mating surfaces. Here again a feed of 0.020 to 0.025 in. may be satisfactory for finishing, although 0.015 in. feed may have been used for maximum tool life in roughing.

On old vertical boring mills, when used to machine armor plate, considerable trouble frequently can be avoided by reducing all feeds 50 percent by changing feed gears. Such old boring mills, as well as some new ones, have minimum feeds of 0.025 to 0.031 in. per rev. When used for interrupted cuts, the result generally is reduced tool life and occasional tool breakage when the tool encounters hard spots. Reducing all feeds by change gears will frequently be found to actually reduce the average floor to floor time on such machines.

When armor plate castings have a decided runout, as sometimes occurs, tool breakage can be reduced if the tool is brought up to the highest spot on the surface by rapid traverse and then throwing in the regular feed. Reducing the feed too much when hard spots are encountered is no help, however, since the tool then merely rides the cut. In such cases it is better to temporarily reduce cutting speed.

It is virtually impossible to set definite specifications for cutting speeds in machining cast armor plate. Much depends on the presence of hard spots, etc., which may require varying the speed from piece to piece and also while machining a single piece.

When rough machining interrupted cuts it is suggested, however, that a starting speed of about 100 ft. per min. be used or that the "normal" speed should be around 90 to 150 ft. per min. At the start of the cut, these speeds should probably be not greater than 100 ft. per min. to ease the impact load on the tool, enabling it to penetrate the scale, hidden hard inclusions and sand pockets. If, after starting the cut, the casting is found to be real bad, it may even become necessary to reduce the speed with a rheostat to as little as 75 ft. per. min. to reduce impact. As soon as the material becomes cleaner the speed can be again increased to 100 ft. per min. or even 150 ft.

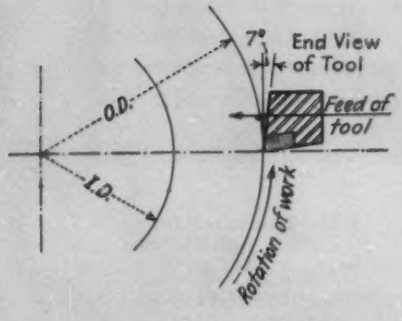


Fig. 13—Relief angles on standard tools are sufficient for facing cuts started at the outside diameter and fed toward the center of the work. Special tools must be ground when the facing cut is to be taken in the other direction

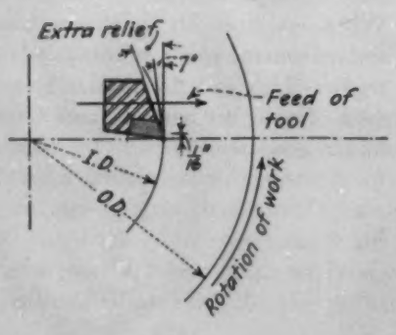


Fig. 14—Where the facing tool is to be fed across the work from the inside diameter toward the outer edge, increased clearance must be ground behind the cutting edge to insure against the heel of the tool dragging on the finished work

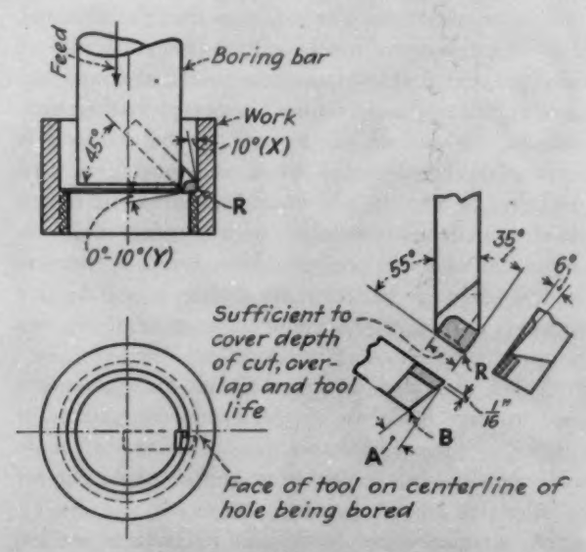


Fig. 15—When the boring bar holds the bit so the cutting edge is "on center" with the work, first grind the 7-deg. relief all around and then grind secondary relief angle *A* up to 1/16 in. from the cutting edge around 35-deg. angle and around entire radius *R* to prevent heel *B* of tool dragging in the cut

per min. or higher, depending on the nature of the part being machined. To determine when this is necessary is usually relatively simple. When machining armor plate castings, chips come off with a characteristic "whistle". When a hard spot is encountered the tone changes.

For continuous cuts there is no difficulty in operating tools at speeds of 150 to 250 ft. per min., depending entirely on machine and work conditions. The higher speeds of course should be used with the cleaner material. Best practice on continuous cutting is to start at around 150 ft. per min. and increase the speed until the best machining time has been obtained without creating other difficulties.

Frequently, in facing interrupted cuts on vertical boring mills, a poor finish will be found as the tool reaches a smaller work diameter (see Fig. 12). Here the tool may have been started at its proper cutting speed but after a while the tool may become underspeeded as the work diameter is decreased. Such under-speeding may be readily determined by the presence of a poorer finish together with a sluggish type of chip. Underspeeding tends toward reducing tool life and can be corrected only by increasing the surface speed (in feet per minute) to approximately the value used at the start of the cut by means of a rheostat control. Such a control not only quickly improves machining conditions, and saves the tool, but also reduces the over-all machining time. On the whole, it is questionable whether carbide tools should be used even on interrupted cutting operations at speeds of less than 75 ft. per min., since the intense chip pressure on the cutting edge may cause rapid tool breakdown. If higher speeds are not available on the machine, it may be better to use a high-speed steel tool and operate at a cutting speed of 25 to 65 ft. per min. In this case, the best practice would be to start at 25 to 30 ft. per min. and increase the speed to where a satisfactory combination of tool life and machining time is obtained.

When taking facing cuts it is usually desirable to start the cut at the outside diameter and feed toward the center. The main reason is that the relief on a standard tool is sufficient to handle all facing cuts in this direction, avoiding the necessity of special tools (see Fig. 13). If a tool has to be fed outwards from the inside diameter, the tool should be provided with increased relief behind the cutting edge to insure free cutting. This is illustrated in Fig. 14.

It is a well-known axiom that the use of a single point tool properly supported is the best way of

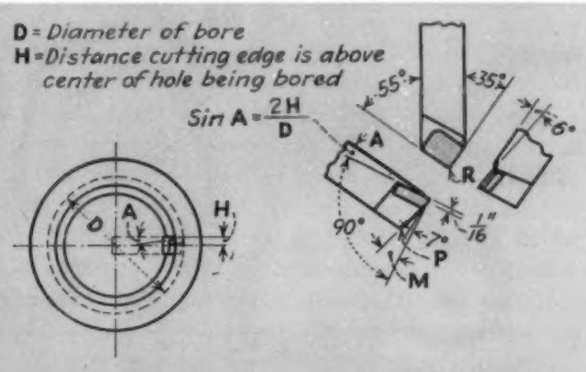


Fig. 16—If the bit is positioned "ahead of center" by the boring bar, grind the 7-deg. relief all around. Then grind secondary relief angle *M* up to 1/16 in. from the cutting edge around 35-deg. angle and around entire radius *R* to prevent heel *P* of tool dragging in the cut. Cutting edge must be radial

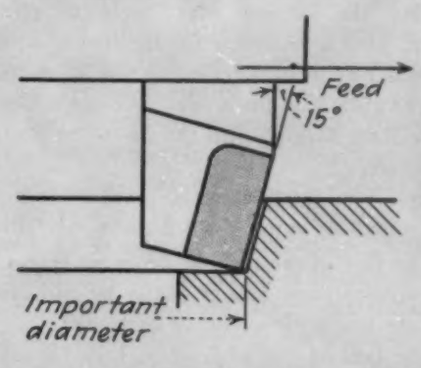


Fig. 17—Forming cuts can be taken at high speed with sharp tools if 0.002-in. stock is left on a side and the tool is fed into the work rapidly, then backed out again before the work has turned more than 1¼ revolutions. With practice, mirror-like finishes can be secured

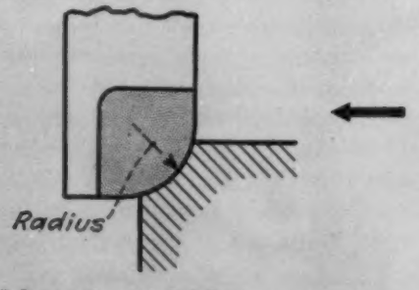


Fig. 18—Highly-finished, accurate ball races can be formed at high speed in armor plate castings when the proper procedure is followed. The area is first roughed, then semi-finished, leaving 0.002-in. stock for the final cut. The roughing tool then is replaced with a sharp tool before taking the final cut

truing rough holes or holes which are out of alignment. Whether or not carbide boring bits can be used for this work depends on whether it is possible to obtain the correct speed-feed relationship on the machine in question. If this is possible a carbide boring bit can be designed which will not only maintain size more accurately but will also produce a straighter hole with longer tool life than any other cutting tool material. The smaller wear on carbide tools also insures that there will be less chance of the hole being tapered, particularly when boring involves a long cut.

Most single point boring bits are located in a boring bar in one of two positions, either on center as shown in Fig. 15, or ahead of center as shown in Fig. 16. Either method is applicable to the use of carbides, providing the cutting portion of the bit is properly designed or selected.

The boring bit, as will be noted in the two figures, is set in its bar at a 45 deg. angle. Any other angle, if practical, will work equally well providing the values of the angle X and the angle Y, as measured with the work, are maintained. Maximum tool life for roughing cuts is usually obtained when the side cutting edge angle is somewhere between 5 and 10 deg. For finishing cuts, it may range between a 5-deg. positive angle as shown to about 5-deg. negative angle. The latter is required at times for cuts to shoulders. In the latter case the nose radius leads, permitting the cutting edge angle to clear the shoulder. If it is necessary for the tool to square up the shoulder as well as bore, the tool of course will have to be ground to the proper rake angle to prevent the nose from digging into the cut when it contacts the shoulder.

General considerations to be observed in any boring operation on armor plate include the following:

1. The face of the tool should be on center. This can be accomplished (see Fig. 16) by providing the face of the tool with a positive back rake.

2. The heel of the tool (B in Fig. 15 and P in Fig. 16) must clear the cut. This means that increased relief must be provided. This relief should be carried around the heel of the nose radius as previously mentioned. We cannot over-emphasize the importance of this point. Frequently, apparently unimportant grinding touch-ups not followed by checking as to whether the relief was correct around the radius, result in rough finish in the hole, in chatter, in reduced tool life, and constant need for resharpening the tool.

On boring bits the nose radius should be held as small as possible. Unless absolutely necessary, do not exceed $\frac{1}{32}$ to $\frac{1}{16}$ in. radius. Large radii tend to make the tool wedge in the cut and chatter when the boring bar is in its extended position.

If required, it is entirely feasible to use a carbide tool for forming while also producing a mirror-like finish at the end of the cut. This is illustrated in Fig. 17. Here a 15-deg. angular type tool is being fed in the direction indicated up to a diameter which has to be held to a close tolerance. This can be accomplished by first roughing and then semi-finishing, leaving 0.002-in. stock to be removed on the side. The roughing tool is then replaced by a sharp tool and the latter is set to gage. Speed should be increased to around 250 ft. per min. With the work rotating, the tool should be fed quickly into the work to the required 0.002-in. depth and then rapidly backed out again. The work should not be allowed to rotate more than about $1\frac{1}{4}$ revolutions before the tool is backed out. Fig. 18 shows the manner in which a highly-finished, accurate ball race can be formed in the same manner. The same principle of operation can be applied to the finishing of other surfaces requiring mirror-like finishes.

The quickest sign of whether a tool is sharp or not is obtained by watching the chips as they curl away from the tool. With a perfect cutting edge, the chip is uniformly silvery along the entire cutting edge. A breakdown of the edge is quickly indicated by a straw-colored band appearing on the rough surface of the chip. This band runs in the direction of the chip flow.

The appearance of streaky discoloration, or when the chip becomes reddish in color, is almost always an indication that the tool needs sharpening. Both from an over-all output and tool life standpoints, tools should be sharpened before they become too dull. If the latter is not done, machine performance will decrease, while the tool will eventually require a greatly increased amount of grinding due to accelerated breakdown of the cutting edge.

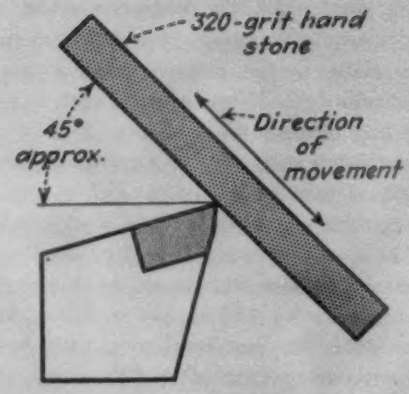
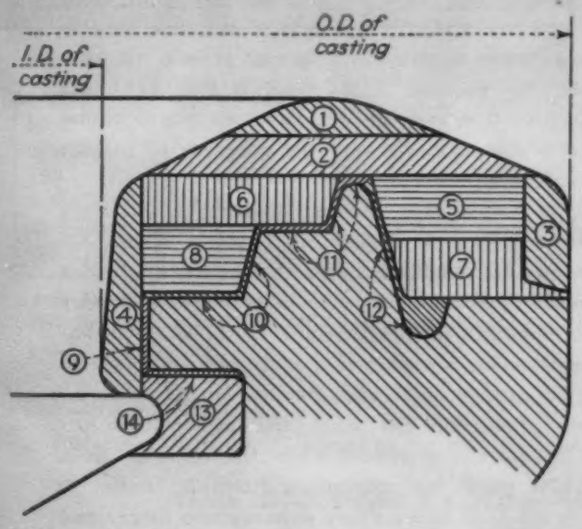


Fig. 19—Hand stoning the cutting edge of a carbide-tipped tool increases the life of the tool because it removes the ragged portion of the edge which will chip out on interrupted cuts

Silicon carbide grinding wheels are suggested for all routine grinding of tools used for machining armor plate castings. A 60-grit wheel is more open and much cooler cutting than the much finer grit wheels so often used for rough grinding. This reduces the tendency of overheating and cracking the heavy carbide tips.

In finish grinding a satisfactory edge can be produced on most tools with an 80-grit wheel. This wheel should be used merely to smooth the cutting edges of the tool by applying light hand pressure. In some cases the 80-grit wheel may leave too rough a finish on the work. This applies in particular to some radius tools or form type of tools used for a finishing operation. For this class of work a 120-grit wheel is frequently used to lightly smooth off the grinding marks left by the 60-grit roughing wheel. As far as the technique of grinding is concerned, the same procedure applies as for grinding carbide tools used on other types of materials.



Cut No.		Use Tool No.	In R.H. or L.H. Head	RPM	Feed	Tool Setting Block No.	Remarks
1	Same Time	D-1234 T-1	L.H.	12	0.015	—	Only necessary when cut is too deep for tool in cut No. 2
2	Same Time	D-1234 T-1	R.H.	12	0.015	D-1234 T-15	
3	Same Time	D-1234 T-2	R.H.	10	0.015		
4	Same Time	D-1234 T-1	L.H.	10			

Fig. 20—A properly made planning chart shows in detail the cuts to be taken to convert a rough casting to a finish machined part. Such charts are useful in estimating job requirements, determining tools required, and in conveying to the machine operator the procedure to be followed for best results. For the sake of clarity, the cut taken by each individual tool is numbered separately, although two or more cuts may be taken at the same time in the same machine

Next, the cutting edge of the tool should be stoned before it is used. Indications are that this stoning actually lengthens the tool life since it removes the microscopically ragged portion of the cutting edge which would rapidly chip out and break down on interrupted cuts. The stone should be about 320 grit. It should be held at about a 45 deg. angle with the top of the tool as shown in Fig. 19, and should be moved in the direction indicated while it is also given a slight movement along the cutting edge. For finish cuts only a light stoning, sufficient to remove the grinding burr, is necessary. For heavy roughing or interrupted cuts, the flat or chamfered surface left by the stone should be about 0.002 to 0.005 in. wide. This stoning should be done by some one who is familiar with the machining operation in question, otherwise there is a possibility of ruining the tool.

Tool grinding never should be left to the individual operator since this increases the down-time of the machine by taking the operator from the machine. Also, grinding of tools is a specialized art and can be performed most quickly and most accurately by men whose sole job it is, day in and day out, to grind tools to required dimensions and tolerances. While correct grinding may take a little longer than incorrectly grinding a tool, the difference in life between grinds when machining armor plate castings is such that the average grinding time per piece produced is considerably less for the correctly ground tool.

One of the most useful procedures in machining an armor plate casting is the preparation, before actual tooling, of a planning chart which will show in detail the cuts to be taken to convert a rough casting to a finish machined part. Fig. 20 shows a typical chart of this kind which includes a section drawing of the finished part superimposed on the rough casting. The part shown is not an actual one, but is typical of conditions to be met in machining many armor plate castings. Note that the chart shows the order of the various cuts while the tabulation indicates the type of tool to be used, where it should be placed on the machine, the revolutions per minute and feed required to produce the correct speed-feed relationship, as well as other data. For the sake of clarity, the cut taken by each individual tool is separately numbered, although two or more cuts by two or more tools may be combined in the same operation. This is useful practice since it indicates readily to the operator which tool should enter the cut first.

Drawings such as these with their accompanying cutting instructions have been found tremendously useful in reducing machining time on armor plate

castings as well as other forms of large castings in which a number of different cuts were required. For instance, in Fig. 20, turning the outside diameter at "3" or boring at "4", before taking facing cuts "5" and "6" will materially reduce the over-all time since the latter are to be followed by two more facing cuts "7" and "8". Similarly, the finish boring operation "9" is placed ahead of finishing operation "10". The stock to be removed in operation "12" may be handled by a plunge type cut.

On most machining operations it is always good practice to start a facing cut ahead of a boring or a turning cut. This enables the facing tool to remove all rough stock and leave clean material to start the turning and boring tools. This routine assists in protecting those tools which may have to hold size within definite limitations for the longest time.

Every cut taken after the first finishing cut, of course, represents waste time. As a matter of fact a number of light cuts having a depth of only a few thousandths (0.002 to 0.015 in.) will produce a poorer finish (due to work-hardening) than when the finishing cut is 0.045 to 0.060 in. deep. In addition the multiple light cuts also result in rapid loss in size maintenance because of increased tool wear.

A good rule to follow in machining cast armor plate is never to take two or more cuts where a one-pass finish may be satisfactory. When it is necessary to follow a rough cut by a finish cut leave 0.045 to 0.060 in. stock for finishing. This gives the finishing tool increased tool life while improving finish and maintaining size much better.

On many vertical boring mills, it is possible to use two vertical rams for machining and reduce the over-all machining time where only one ram is normally being used. Best procedure on such machines is to set up one tool in its holder and bring it up to the cut, ready to throw in the feed. Then set the proper feed for this tool. Next set up the other tool in its tool holder and bring it up to its cut. Set the proper feed for this tool. Check for an average speed for the two cuts (facing, turning or boring) and make the proper speed setting on the machine. If a coolant is necessary, adjust connections to suit cuts. Start the machine and throw in first one tool feed and then the other.

Fig. 21 shows such a set-up. The tool taking the longest cut is, according to good practice, located in the left-hand ram where its face is not visible to the operator. The tool taking the shortest cut is located in the right-hand ram where the face of the tool is visible. With both tools starting to cut at approximately the same time, the operator now has an opportunity to stop the tool in the right-hand ram after it has completed its cut and before it hits the shoulders on the work, permitting the tool in the left-hand head to go on until it has reached the end of its cut.

Similarily, in Fig. 20, if operations "7" and "8" are performed simultaneously, tool No. 8 should be in the right hand ram and tool No. 7 in the left hand ram. Tool No. 8 is started first and then tool No. 7. The operator now watches tool No. 8 to stop the feed when it has reached the finish of its cut and can then turn to watching tool No. 7.

Rules for planning the machining of armor plate castings cannot be made specific. A layout like that in Fig. 20, however, will quickly reveal in each instance the present depth and sequences of cuts which will give minimum floor to floor time. Frequently, it is found that several operators on as many machines, running three shifts of work on the same job, will vary widely in their floor to floor time. This is usually traceable to lack of proper planning and therefore lack of uniformity in practice.

In making a sketch such as shown in Fig. 20, it has usually been found desirable to make it full sized and properly scaling the depths of cut as a help to the operator, especially if the job is new to him. When this practice is followed, it will be found frequently that even greater increases in production are available than through the adoption of carbide tools alone.

It is not always an easy matter to introduce planned cutting in a shop, particularly where the operators are old hands. Here the introduction of a new form of tool (carbides) is of major assistance in improving machining practice in the shop. What little objection is encountered at times from operators because carbide tools and planned cutting will increase production per hour and per machine, is usually quickly overcome when the operator finds out how much less continuous attention he has to pay to the tools because they remain sharp longer and also how much less work there is for him in setting and resetting the tools.

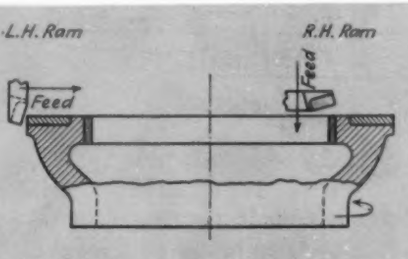


Fig. 21—When using both rams on a vertical boring mill, it is best practice to mount in the left-hand ram the tool taking the longest cut. The tool taking the shortest cut is placed in the right-hand ram where its face is visible to the operator

Bend Radii for Sheet-Metal Forming

Courtesy Vega Aircraft Corporation

ALUMINUM ALLOYS

In some cases the minimum bend radii for various aluminum alloys are not applicable to all methods of forming, and it is, therefore, advisable to use a radius wherever possible that has a wider application, that is, for use on either the power brake, hydro press or the punch press. Such radii are shown in Table I.

Recent developments in the handling of ST material have made available smaller radii than those formerly used for some applications, and the absolute minimum will depend on the design of the part and the method to be used in its fabrication.

Table I—DESIRABLE BEND RADII FOR ALUMINUM SHEET

	Thickness of Sheet													
Material	0.012	0.016	0.020	0.025	0.032	0.040	0.051	0.064	0.081	0.091	0.102	0.123	0.156	0.187
24SO	1/8	1/8	1/8	1/8	1/8	1/8	1/8	3/16	7/32	7/32	7/32	5/16	5/16	5/16
24ST	1/8	1/8	1/8	1/8	1/8	1/8	3/16	7/32	5/16	5/16	3/8	1/2	5/8	3/4
24SRT	1/8	1/8	1/8	1/8	1/8	3/16	7/32	7/32	5/16	3/8	1/2	5/8	3/4	7/8
3SO	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	7/32	7/32	5/16	5/16
52SO	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	7/32	7/32	5/16	5/16
3S-1/2H	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	1/8	7/32	7/32	5/16	5/16
52S-1/2H	1/8	1/8	1/8	1/8	1/8	1/8	1/8	3/16	7/32	5/16	5/16	3/8	1/2	5/8

Note: Parts made from 24SO should specify 24ST bend radii wherever possible. For drop hammer or deep drawn parts use the largest possible radii consistent with design requirements.

FERROUS ALLOYS

X-4130 steel can be safely formed to the radii in Table II.

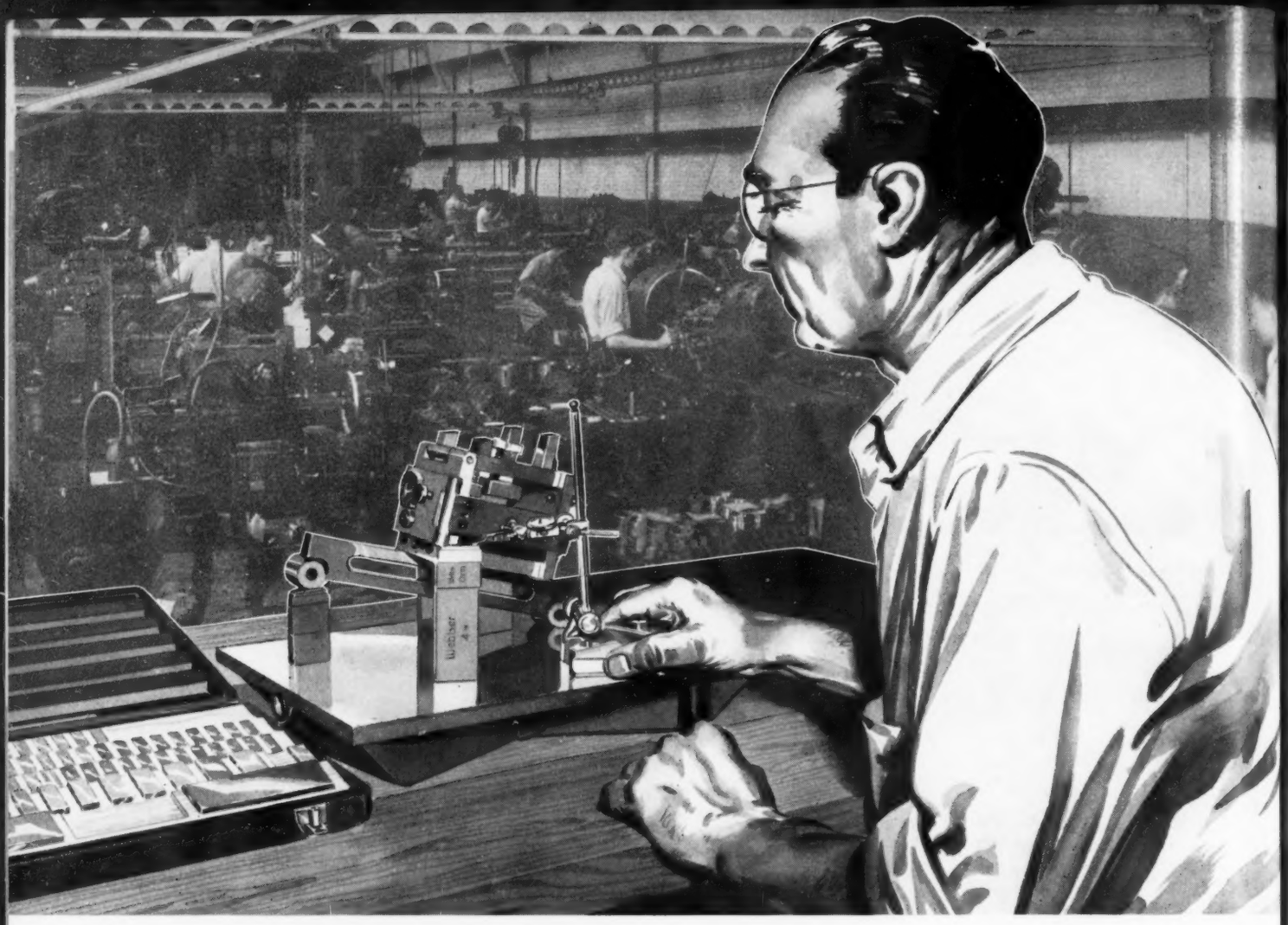
Table II—DESIRABLE COLD BEND RADII FOR X-4130 NORMALIZED STEEL

Gage	0.025	0.035	0.050	0.062	0.078	0.093	0.125	0.156	0.187	0.250
Radii	3/32	1/8	5/32	3/16	1/4	9/32	3/8	15/32	9/16	3/4

Note: Drawings of parts calling for minimum radii should specify that the bend must be normal to the direction of grain and that the edges of the parts must be burred. In some cases, it may be necessary to anneal normalized sheets before forming and when this occurs the drawings shall carry the note "Anneal before forming, normalize after forming."

Table III—DESIRABLE BEND FOR STAINLESS STEEL AND INCONEL

Alloy	0.012	0.020	0.025	0.030	0.042	0.050	0.062	0.120	0.187
302-1A	1/16	1/16	1/16	1/16	3/32	1/8	1/8	1/4	3/8
302-1/4H	1/16	1/16	1/16	1/16	3/32	1/8	1/8	1/4	3/8
321-1A	1/16	1/16	1/16	1/16	3/32	1/8	1/8	1/4	3/8
347-1A	1/16	1/16	1/16	1/16	3/32	1/8	1/8	1/4	3/8
Inconel-1A	1/16	1/16	1/16	1/16	3/32	1/8	1/8	1/4	3/8
302-1/2H	3/32	1/8	5/32	3/16	1/4	5/16	3/8	3/4	1 1/8
302 H	3/32	1/8	5/32	7/32	9/32	11/32	3/8	3/4	1 1/8



The LABORATORY is moving into the SHOP

Not so long ago Precision Measuring Equipment (such as the set of Webber Gage Blocks shown in the picture above) was seldom seen outside the laboratory. Its use was confined to relatively few manufacturers who brought such equipment out of its vault with great ceremony and only on rare occasions.

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Grinding Wheel Marking System

AFTER A YEAR'S TRIAL, the grinding wheel marking system developed jointly by General Motors Corporation and the Grinding Wheel Manufacturers Association was made effective Dec. 31, 1941, for material supplied to the corporation's plants. Subsequently, General Motors relinquished all rights to exclusive use of the system. Thereupon, the Grinding Wheel Manufacturers Association adopted the system as standard for the grinding wheel industry, and presented the code to the American Standards Association for adoption as a national standard. Initial action by ASA indicates that the system will be adopted without change as a national standard.

The grinding wheel marking system simplifies the specification, ordering and stocking of wheels. All grades and types of wheels now in use are covered by the code, eliminating confusion arising from diversity of symbols developed by the various grinding wheel manufacturers. An important value of the standard is that the shop man can become more expert in selecting a wheel with the characteristics required for a given operation.

The following is an outline of the standard wheel markings to be used:

SEQUENCE OF MARKINGS: Each marking will consist of six parts, placed in their proper sequence, as follows:

1.	2.	3.	4.	5.	6.
Abrasive	Grain Size	Hardness or Grade	Structure	Bond or Process	Mfrs. Records

1. *A letter representing the Abrasive, as follows:*

A—Aluminum Oxide—Regular B—Aluminum Oxide—Refined
AB—Mixture of Regular and Refined Aluminum Oxide or Semi-Friable Abrasives
C—Silicon Carbide—Regular CG—Silicon Carbide—Refined
D—Corundum E—Emery F—Garnet

2. *A number representing the Grain Size, as follows:* 8, 10, 12, 14, 16, 20, 24, 30, 36, 40, 46, 50, 54, 60, 70, 80, 90, 100, 120, 150, 180, 220, 240, 280, 320, 400, 500, 600, etc.

In addition to nominal grain size, combinations will be indicated by numbers 1 to 4 following the grain size number.

The average grit size in a combination shall be established by averaging the designating numbers of all of the sizes in the combination based on proportions by weight.

All straight grain wheels and no others shall be designated by the nominal grit size without suffix.

If the average grit size in a combination should exactly coincide with any nominal grit size, the designation shall be that nominal number followed by the suffix 1.

The suffix 2 shall be used to designate all combination wheels the average grit size of which falls in the coarsest third of the range between the nominal size and the next finer.

The suffix 3 shall be used to designate all combination wheels, the average grit size of which falls in the middle third of the range between the nominal size and the next finer.

The suffix 4 shall be used to designate all combination wheels, the average grit size of which falls in the finest third of the range between the nominal size and the next finer.

NOTE: Successively larger suffixes do not necessarily indicate finer finishes. Combinations are used to make wheels stronger, or to give additional pieces per dressing or some other desired characteristic of wheel action.

3. *A symbol representing the Hardness or Grade in accordance with the following scale:*

STANDARD GRADE SCALE					
	S1		M1		H1
	S2		M2		H2
	S3		M3		H3
SOFT	S4	MEDIUM	M4	HARD	H4
	S5		M5		H5
	S6		M6		H6
	S7		M7		H7

4. *A number representing the Structure, as follows:*

Preferred Numbers 2 5 8
Available Numbers 1 3 4 6 7 9
Where 1 is the most dense, 5 is medium and 9 the most open.

5. *A letter representing the Bond or Process, as follows:*

V—Vitrified S—Silicate
E—Shellac or Elastic R—Rubber
B—Resinoid (Synthetic Resins such as Bakelite, etc.).
O—Oxychloride

6. *A symbol representing the manufacturer's records.*

Each grinding wheel manufacturer is at liberty to use the sixth position for private factory records.

MARKING: A dual marking system, whereby the adopted standard markings are to have preferred position above the grinding wheel manufacturer's individual markings when the size of the wheel permits.

Wheels too small to permit standard markings shall be wrapped and tagged showing the standard wheel markings above the manufacturer's individual markings. In addition tag must show the name of manufacturer and the purchase order number.

EXAMPLE: To serve to illustrate the standard wheel markings placed in their proper sequence along with the manufacturer's individual markings, a typical example is shown below.

	Abrasive	Grain Size	Hardness or Grade	Structure	Bond or Process	Mfrs. Records
G.M.	B	461	M2	5	V	E
Mfr.	38	46	K	5	BE	
Mfr.	AA	46	N	5	F	

HOW GOOD A SCRAPPER ARE YOU ?

How about taking *another* sock at the Axis—aside from the healthy punches you're delivering with war production? Round up all the iron and steel that it's not absolutely essential to keep. Do it both at the plant and at home. Then turn it in for scrap, even if some of it hurts!

In plain words, here's the picture. Steel producers are going to need several million *more* tons of scrap this year than ever before. If we don't get it, you won't get enough *new* steel; and if you're pinched, it's the boys on the fronts who will suffer. • It can be either a vicious or victorious circle. *Will you do your share—and more—to make it the latter?*

AL

STEEL FOR THE NATION'S WELFARE

Allegheny Ludlum

STEEL CORPORATION

GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

No Longer A Man's Job

WAR SHATTERS TRADITION in short order. One of the traditions currently being riddled is that woman's place is not in the shop.

This is a fight-to-the-finish. Its global dimensions are so vast that all of our resources are already being taxed. Never has a war demanded so many men in the field and so many people at home to keep them supplied with food and equipment.

Our manpower is not unlimited. So Uncle Sam must turn to the women of America for help.

The WAACS and WAVES are the spectacular and dramatic proofs of woman's part in the war. They are destined to perform valuable tasks directly related to the war effort.

But a job of even greater importance, though less front-stage, must be done by American women in our war factories. They must replace hundreds of thousands, perhaps millions, of able-bodied men who will be called into active military service.

The fact is that the movement of women into industry is well under way. The War Department has 300,000 of them on its payrolls. They work in arsenals and depots, producing and assembling guns, planes, tanks and ammunition. They are running 15-ton cranes, operating complex milling and boring machines, driving trucks, riveting airplane wings and filling many other mechanical jobs as well as doing clerical and supervisory work.

Private industry, deep in its war task, is hiring more and more women. Over 80 percent of the trainees in Detroit schools cooperating with war goods manufacturers are women. One big company operating its own training program is taking on only women for riveting and welding jobs.

Industrialists are discovering that women are thoroughly competent to do work formerly reserved for men. Some manufacturers will whisper to you in confidence that women, after a relatively short training period, are producing more and better than men ever did.

Every live management should act now to secure women workers rather than postpone what some of the die-hards call "the evil day." They will have to employ women eventually, so why not now?

If they dilly-dally, they will discover that the best and most adaptable women have been snapped up by their competitors.

Sure, it seems strange to have a machine shop peopled with women. Sure, it is a bother and an expense to create new facilities for their comfort. Sure, you feel a little queer about having them do work that has always been looked upon as "a man's job."

But we have just one task ahead of us—winning the war. All other considerations fade into insignificance. To do that, we must make the best possible use of our woman power as well as of our manpower.

The War Department states the case admirably to its employing and training officers. They have been directed to "fully utilize, immediately and single source of labor available today—the vast effectively, the largest and potentially the finest reserve of woman power."

If private manufacturers are as smart as we think they are, they will take a tip from the War Department and tap this new and invaluable source of war labor now.

Burnham Finney

GAGING BUSINESS

War production will be studied by items to attain proper balance. Subcontracts will be controlled to secure delivery of parts. Machine tools backlog increasing again

To bring war production into better balance, the War Production Board intends to examine the situation in each of the main items needed by the military and naval forces to see whether the schedule is being met, beaten or delayed. Where output is far in advance of production of related weapons, operations will be curtailed.

Work is likely to be halted on some munitions plants approaching completion where it becomes evident that more capacity exists than can be balanced by the present and potential output of related items. There is even talk in Washington that some plants may be dismantled to salvage the materials and equipment for badly needed production in other lines.

No new plants will be authorized for any purpose so long as present productive facilities can be utilized. This policy will be drastically enforced though terrific pressure against it is expected from business men as well as from politicians.

Subcontractors Controlled—Production of components and subassemblies going into war weapons will be treated the same as main items in balancing output. Much of the difficulty lately in maintaining full production of critical products has been the inability of prime contractors to secure delivery of parts. There still is no evidence that the smaller war plant corporations will get a chance to spread much work.

Government engineers with long experience in the automotive industry are advocating a policy of placing the control of materials in the hands of prime contractors. The contention is that the automobile industry has been able to maintain the flow of materials, parts and subassemblies with limited inventories.

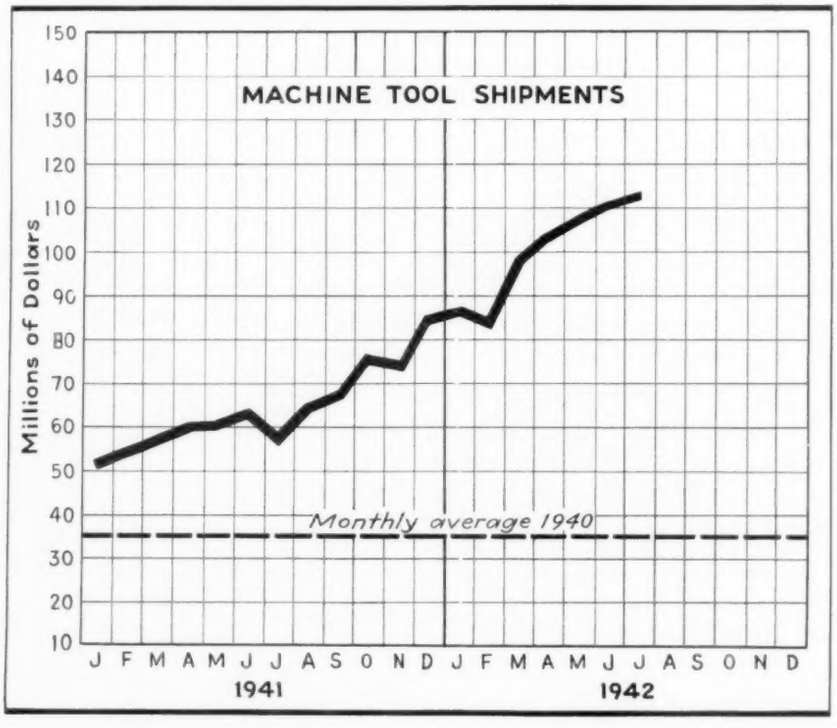
Plan Wins Support—The armed forces are said to be favorable to this policy, though it would concentrate control of materials in a group of fewer than 500 prime contractors. There is said to be differences of opinion within WPB over delegating control of materials to private concerns in such manner. Strenuous political opposition to this control plan is looked for. Organized labor is certain to oppose it, because it already feels that too much war production is placed with the country's larger manufacturers.

Backlogs Bigger—Following a decline in new machine tool orders reported by a number of builders, the backlog of the machine tool industry has risen again and is at an all-time high. Cancellations have been more than offset by new orders in numerous cases. Some companies, which saw their unfilled volume of business retreating in recent weeks and which fully expected to have to turn to munitions production by next spring, have accumulated new bookings to keep them busy through the first half of 1943. One builder reports that deliveries fell recently from 12 months to eight months, but is now back up to 12 months.

Pool Orders Large—So-called pool orders now in the possession of machine tool builders are said to amount to almost $750,000,000 or close to half of the industry's backlog. In vital types of machine tools the government is placing pool orders through the first half of next year. WPB is examining closely requests for pool orders from machine tool builders, however, to make sure that machines so produced are absolutely essential to the war effort. Pool orders serve the commendable purpose of providing business for machine tool builders so that their production will not lag even if specific orders from war contractors are slow in coming through. Delays in deliveries of vital machine tools thus are avoided.

Big Engine Programs Up—Biggest tooling projects at the moment are for two mammoth aircraft engine factories. Part of the machine tools for them have been placed, but a substantial volume still is to be allocated. Makers of tanks, armor plate and ship machinery are seeking large special purpose equipment to expand their productive facilities. In certain lines of machine tools recent cancellations of orders have made available limited quantities of machines for delivery within two or three months and in a few cases have enabled builders to accumulate small stocks of certain sizes of machines.

Materials Scarcity Unrelieved—Machine tool builders continue their efforts to get enough materials, particularly steel, to prevent a slowdown in operations. Some New England companies, unable to secure their requirements from their regular sources, have been combing the steel warehouses of the middle west. Steel is being shipped from Cleveland and other midwest points to New England to relieve shortages reported by machine tool builders.



Production Leveling—July output of machine tool units amounted to 28,300 valued at $113,600,000. During June 26,600 units valued at $111,147,000 were shipped. Value in July represents an increase of 96 percent over last year

Scheduling of Cutting Tool Output Ordered

Starting October 1, 10 percent of cutting tool output is to go to original tooling, 90 percent to war contractors. Assistance offered auto industry by this new WPB order

WASHINGTON—Because the peacetime cutting tool industry is not large enough to keep up with the growing demand, the War Production Board has issued Order E-2-b, requiring producers to schedule their deliveries by the month by types, beginning with October. Ten percent of output goes to original tooling, and 90 percent to war contractors. Order E-2-a is out.

The 10 percent of the producer's total output of each type of cutting tool must be scheduled for delivery against purchase orders for that type of special cutting tool required for original tooling. Note that "special cutting tools required for original tooling," as defined in the order, means special tools required for new and rebuilt machine tools, or for machine tools which are being adapted for new uses.

This latter provision is mainly intended to assist the automobile industry, whose machine tools, being converted from autos to munitions, need different tooling. Procurement of this needed tooling was not assisted by the companies' positions on the Urgency List. Therefore assistance is offered in E-2-b.

Original Tooling Provisions

With reference to this 10 percent for "original tooling" there are four provisions: (1) No order shall be scheduled unless it was received at least 45 days prior to the first day of the month being scheduled and unless it bears the purchaser's endorsement. Wording of this endorsement is given in the order. (2) Sequence of deliveries shall be scheduled in accordance with Priorities Regulations No. 1 which means all the general rules about the priorities system. (3) Purchasers may apply their endorsements to existing orders by letter on or before September 15. (4) Any portion of the 10 percent of production not ordered under these terms shall be transferred to "other purchase orders"—the 90 percent group.

"Other purchase orders," 90 percent of total production, shall be scheduled for delivery under four provisions: (1) No order shall be scheduled unless it carries either one of two "endorsements," both worded in Paragraph b of the Order. (2) Orders for special cutting tools required by prime or subcontractors of the Army, Navy, Maritime Commission, or War Shipping Administration, as a result of a change in design of product being produced, shall be given preference over all other orders. But this preference is given only if the order was received 15 days or more before first day of the month being scheduled, and only if it carries an endorsement, which is quoted in Paragraph b. (3) With certain exceptions, sequence of orders shall be scheduled under the terms of Priorities Regulation No. 1. (4) Endorsement of existing orders may be applied by letter.

The "endorsements" above referred to, three different versions, are simply the purchaser's affirmation that the cutting tools are necessary and that their acquisition will not unduly increase inventory. Some tool builders complained that one endorsement, covering all three situations would have been enough. They object, as they did in the case of the long-winded machine tool allocation order E-1-b, to the involved legal terminology; they feel plain English would save time.

Restrictions on Sales

The order sets forth four main restrictions upon sale and purchase:

1. With certain exceptions, detailed in Paragraph d, no person shall sell or buy any cutting tools except under a preference rating of A-9 or higher—except by direction of the Director General of Operations. Purchase orders carrying a rating of A-10 received prior to date of E-2-b (August 31) may be completed and delivered. Other than high speed steel tools defined in Order N-14, which do not have inserted or brazed edges with cemented carbide or hard alloy tips, may be purchased or sold under an A-10 rating or higher.

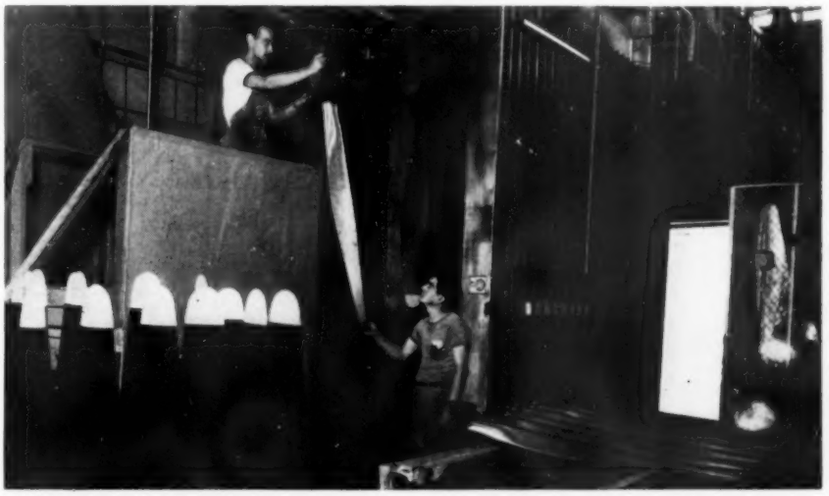
2. Cutting tools may be bought and sold only on orders bearing endorsement, as already described.

3. No person shall buy or sell cutting tools if delivery will at any time increase purchaser's inventory above a 90-day supply—with the following exceptions: (a) orders for quantities which are the producer's minimum for practical manufacturing supply; (b) orders by an agency of the United States; (c) orders placed by Army, Navy or Maritime Commission for cutting tools required at bases or depots outside the country, or at emergency installations within the country; (d) any other purchase specifically exempted by the Director General of Operations.

4. No person shall buy or sell more than three sets of special cutting tools of the same type and size, in connection with any single change in design or other alteration in a product of a prime or subcontractor to Army, Navy, Maritime Commission.

This article does not give all of the detail of the order by any means. It's purpose is to simplify and clarify the order, for initial understanding. You should study the order itself, together with two letters explaining it: one from George Brainard, director of WPB Tools Division, and one from Tell Berna, general manager of the Machine Tool Builders' Association.

Note that the present schedules of deliveries continue in effect until October 1, and that Treasury orders on behalf of Russia, if established by the Director General of Operations, stand as they are regardless of E-2-b.



Prop Camouflage—An operation was added to propeller manufacture when it was found that dull black-painted blades reduce visibility to the enemy. Yellow tips are for safety when the plane is on the ground. At Hamilton Standard Propellers Division of United Aircraft the conveyor-type spraying process is used so that blades are carried through chambers for each step

Ceremonies Held For Army-Navy "E" Awards While More Deserving Plants Are Selected

WASHINGTON—The new production-morale builder, the Army-Navy "E" has been awarded to many deserving plants, has stimulated the competitive spirit in many more. On these pages are shown pictures from a few of the ceremonies.

Supplementing earlier lists (*AM*—Vol. 86, pages 916d, 974d) are the following firms which have been announced as winners of the award. For the first time copper companies, Army Arsenals and Proving Grounds have been included:

Copper Companies

Inspiration Consolidated Copper Co., Magma Copper Co., Miami Copper Co., Phelps Dodge Corp. (Morenci, United Verde and New Corneli Branches), Kennecott Corp., Nevada Consolidated Corp.

Army-Operated Establishments

The Proving Center Aberdeen Proving Ground, Erie Proving Ground, Frankford Arsenal, Jefferson Proving Ground, Picatinny Arsenal, Rock Island Arsenal, Springfield Armory, Watertown Arsenal, Watervliet Arsenal.

Other Winners

Abott Fluorescent Co., Inc., Accurate Brass Co., Inc., Air-Track Mfg. Corp., Alliance Machine Co., Aluminum Industries, Inc., American Machine & Metals, Inc., W. R. Ames Co., Ames Iron Wks., Ansonia Mfg. Co., Arcos Corp., Armstrong Bros. Tool Co.

Beaumont Mfg. Co., Bell & Howell Co., Bonney Forge & Tool Wks., Briggs Mfg. Co. (Conner plant), Cessna Aircraft Co., Chrysler Corp. (Lynch Road, Highland Park, Plymouth, Dodge, De Soto, Jefferson Ave. plants, Airtemp Div.), Clayton Mfg. Co., Climax Molybdenum Co., Combustion Engineering Co., Inc., Corbin Screw Corp., Couse Laboratories, Diamond T Motor Co.

Eaton Mfg. Co., Edgewater Steel Co., Electric Auto-Lite Co., Electric Tachometer Corp., Fafnir Bearing Co. (Booth St., Washington St. plants), Federal Mfg. & Engineering Corp., Flannery Bolt Co. (Oerlikon Div.), Ford Motor Co. (Chester, Pa.), Frigidaire Ordnance Plant General Motors Corp.

Gadsden Ordnance Plant, Gary Steel Products Corp., General Steel Castings Corp. (Commonwealth, Eddystone, Pa. plants), Goodyear Tire & Rubber Co. (Plant 3), G. A. Gray Co., Greist Mfg.

Hall-Scott Motor Car Co., Hazard Insulated Wire Wks. (Div. of Okonite Co.), Joshua Hendy Iron Wks. (Plant 2), Heppenstall Co., Hyde Windlass Co., Independent Pneumatic Tool Co., International Flare Signal Div. Kilgore Mfg. Co., International Harvester Co. (Milwaukee Wks.), International Resistance Co., Independent Pneumatic Tool Co.

Kent Mfg. Co., Kingston Products Corp., Leslie Co., Lidgerwood Mfg. Co., Mergenthaler Linotype Co., Monroe Auto Equipment Co., National Broach & Machine Co., National Supply Co. (Ambridge plant) National Tube Co. (Christy Park Wks.), New Britain Machine Co., North American Aviation, Inc. (Inglewood Div., Texas Div.), Norwalk Co., Inc.

O'Connor Machine Co., Owatonna Tool Co., Philco Corp. (Simplex Radio Corp., Storage Battery Div.), Pressed Steel Car Co., Inc., Pullman Standard Car Mfg. Co. (Butler plant).

Revere Copper & Brass, Inc. (Chicago Div.), Rustless Iron & Steel Corp., Saginaw Steering Gear Div. General Motors Corp., Scripto Mfg. Co., Sharples Corp., Simplex Wire & Cable Co., Snow Shipyards, Inc., Sundstrand Machine Tool Co.

L. H. Terpining, Union Steel Castings Div. Blaw-Knox Co., United States Coast Guard Yard (machine shop), Veeder-Root, Inc., Victory Plastic Co., Vultee Aircraft, Inc. (Vultee Field Div.)

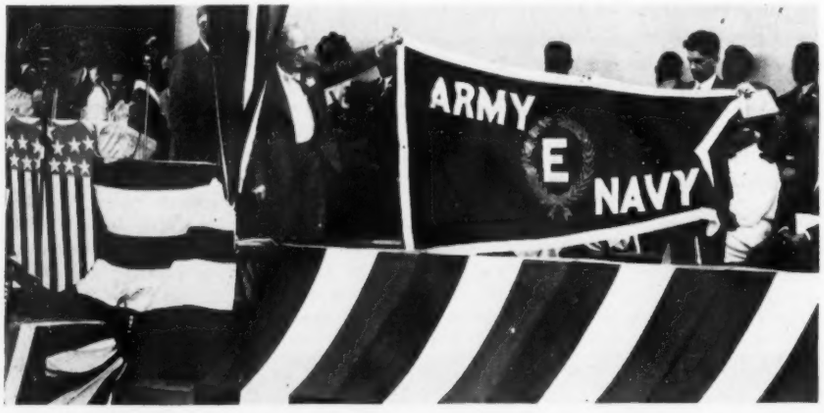
Ward Leonard Electric Co., Weber Show Case & Fixture Co., Westinghouse Electric & Mfg. Co., Weston Electrical Instrument Corp., Woodward Governor Co., Worthington Pump & Machinery Corp.

Renewal Winners

Former winners of Navy "E" awards for excellence in industrial production have received renewal awards. Among the firms announced by Admiral H. A. Wiley, chairman of the Navy Board for Production Awards, are the following:

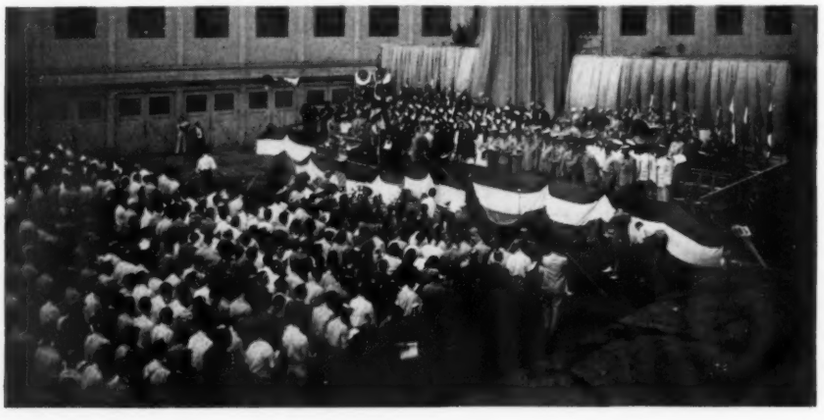
Albina Engine and Machine Wks., Inc., Ardco Mfg. Co., Automatic Screw Machine Co., Bath Iron Wks., Boston Navy Yard, Cincinnati Milling Machine Co., Consolidated Shipbuilding Corp., Dravo Corp. (Neville Island Station, Hunter and Christiana River Shipyards plants).

Ferro Stamping & Mfg. Co., Gibbs Gas Engine Co., Gulf Shipbuilding Corp., Morgan Engineering Co., National Stamping Co., Newport News Shipbuilding and Dry Dock Co., Norfolk Navy Yard, Carl L. Norden, Inc., Norton Co., Quincy Adams Yacht Yard, Inc., Reliance Electric & Engineering Co., W. J. Schoenberger Co., West Bend Aluminum Co.



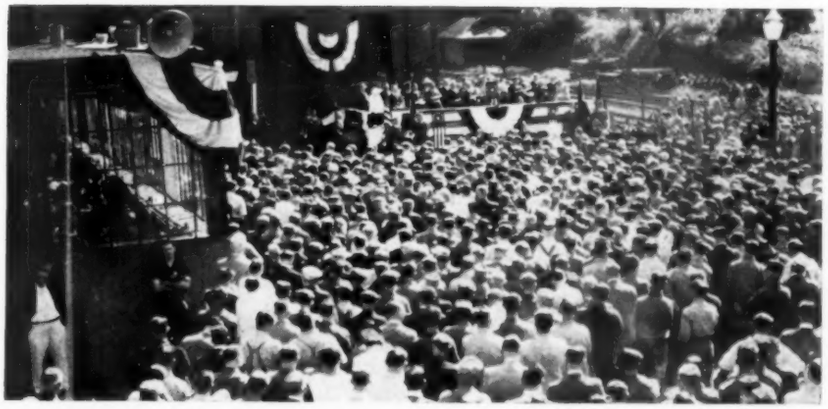
THE BULLARD CO. (above) saw a fleet of army ships fly overhead as E. P. Bullard said that "without machine tools we would have no great armadas of planes." Mr. Bullard and Vincent Hughes hold the flag

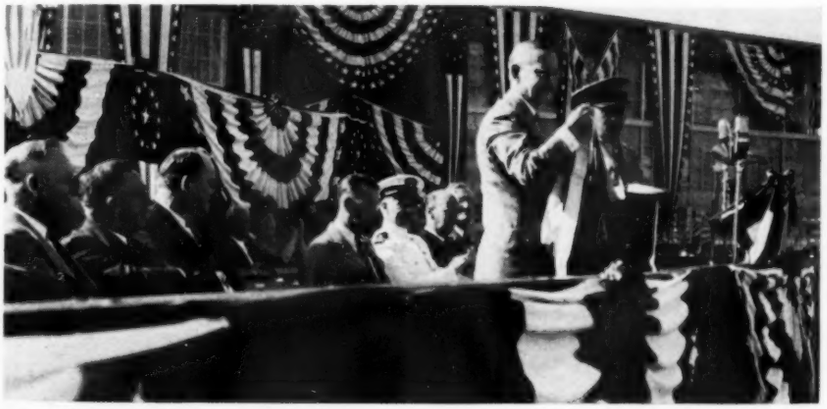
THE R. K. LeBLOND MACHINE TOOL CO. (below) heard Richard E. LeBlond, president, say in accepting the award that "I pledge you greater effort, greater output, greater efficiency, until our enemy is no more"



LANDIS TOOL CO. was honored in a colorful ceremony attended by 4,000. As the award was presented are (left to right) Samuel F. Newman, president of Landis Tool Co., representing management, Brig. Gen. Hugh Minton, Captain F. L. Oliver, and Walter Powell, president of the Independent Associated Workers, Inc., representing the employees

CONE AUTOMATIC MACHINE CO. featured a march to the reviewing stand by 2,400 company employees led by the Conomatic band. Employees presented a scroll signed by all department heads to H. P. Chaplin, treasurer and general manager, and a floral tribute to Mrs. Frank L. Cone, widow of the founder. The flag was accepted for the company by H. P. McClary, president





HANSON-WHITNEY MACHINE CO. employees heard Leon B. Reed, vice president and general manager, say in accepting the award from Col. D. A. Lenk that, "Whether we keep this award and add a new star each six months depends solely upon each of us contributing his maximum ability." Col. Lenk said, "We are going to drop more bombs on Tokyo and you people are going to help us"

GILBERT & BARKER MANUFACTURING CO. was told by Brig. Gen. Burton O. Lewis that the flag "is the signature of your very real and actual accomplishments in the right direction toward ultimate victory and the defeat of the powers that would overrun us." Holding the flag are (left to right) James Dunn, chairman of Gilbarco Employees Conference, and S. C. Hope, president and general manager

Drastic Manpower Control in Lumbering Is Indication of What May Be Done Generally

WASHINGTON — Control over manpower is moving closer as employment in war industries expands, the draft pulls in men at a rate far greater than was anticipated even a few months ago, a stringent shortage of men begins to develop in certain trouble spots.

The most drastic move yet taken came this month in such a trouble spot —the lumbering and non-ferrous mining industries of the western states. These industries have a generally lower wage scale than the neighboring ordnance plants and munitions factories and are losing their men to them. The wage differential is being studied by the War Labor Board, which has some forty cases from these industries before it.

To end the drain of manpower, the War Manpower Commission slapped down an order this month partially freezing miners and lumbermen in their jobs. The order has two parts. One requires a worker leaving his job to get from the U. S. Employment Service a "Certificate of Separation" certifying that he has good reason for quitting. This is not really enforceable with WMC's present powers except through an arrangement with the Selective Service to review the draft classifications of men who leave the industries.

The other phase of the order forbids war industries in the twelve western states to hire anyone coming from the mines or lumber camps unless he has a certificate. This can be enforced through the priority and contracting powers of the WPB, Army, and Navy.

Draft for the Navy

When the Navy, the Coast Guard, and the Marine Corps start getting their men through the Selective Service instead of through voluntary enlistment—as now appears inevitable within the next few months—it will have effects on industry that will go far beyond the comparatively small number of men involved. The reason is that the Navy needs men with specific skills and trades rather than just miscellaneous military material. The change will precipitate a drastic overhaul of the whole system of occupational deferment from the draft—a change which has been under study for several months now. And this change, which is made further necessary by the rapidly increasing tempo of Army inductions, may itself serve to crystallize the whole confused status of controls over manpower.

A call for men by skill classes will impose demands which the present unscientific system of occupational deferment is quite incapable of meeting. It's one thing to tell a local draft board to defer all men who are critically needed in the war-important industries. But if a naval base and a munitions factory both need a skilled machinist, it's a job beyond the capacities of any local board to decide which should get him.

Plant Deferment Plan

The approach with which Selective Service is now experimenting involves the preparation of a deferment program on a plant-by-plant basis. A determination would be made of the minimum number of workers in each occupation required to keep the plant running. Another determination would be made at the rate at which the plan could be expected to train women, older men, and men with large families to replace skilled men of military age. Even as regards unskilled men, provision could be made for withdrawal at an even rate to permit orderly replacement. Such a study ends up with a definite program for drafting—in each month or quarter—so many welders, so many inspectors, so many laborers, etc.

There are still lots of bugs in the scheme. The biggest is finding men with the skill needed to make the personnel studies. The initial experiments have been made in reliable trusted firms where it was possible to rely heavily on the firm's own personnel people. But this couldn't be done if the system were generally applied.

Most significant feature of the whole plan is that it puts the selective service system smack into the middle of the general manpower job. Its problem then becomes much more than a matter of allocating men as between the Army and industry; it would involve allocation within industry. Suppose one plant's schedule shows it has seven patternmakers, needs only four, while another plant is short. Then the extra three men will move to the plant where they can get draft deferment.

Elections Delay Action

Unless Selective Service is to be allowed to take over the whole manpower job by default, McNutt and Roosevelt will have to bestir themselves to pull manpower legislation — the National Service Act—out of its pigeonhole. This sweeping bill which would authorize general allocation of labor is being held up in part by the desire to let such a touchy issue go over until after the elections.

But the immediate cause of delay is uncertainty over what agency shall become the nucleus of the huge organization needed. Two drafts of a bill are now in existence. One, prepared at the behest of the White House, would start with the Selective Service organization. Another, prepared by Manpower Commissioner McNutt's lawyers, would throw the job to the U. S. Employment Service. Both agencies come under the control of the Manpower Commission, but USES is doubly close to McNutt's heart since he has immediate charge of it in his post as security administrator. The two drafts now lie on the desk of a committee charged by WMC with the job of reconciling them. So far, they're just lying there.

DEATH KNELL FOR CDB

WASHINGTON — The Contract Distribution Branch of WPB has been discontinued, and the functions of the branch taken over by the Smaller War Plants Division of WPB and the Smaller War Plants Corporation. Much of the personnel has been transferred to other divisions. Two units of CDB—The Facilities Records Unit and the Critical Tools Service—are being continued under the jurisdiction of the Facilities Utilization Division. B. T. Bonnot has been supervising these functions.

Kanzler Succeeds Houghton As WPB Operations Director

WASHINGTON—Appointment of Ernest Kanzler as director general for operations has been made by Donald M. Nelson, chairman of the War Production Board, to succeed Amory Houghton who has resigned to resume his position as chairman of the board of the Corning Glass Works. Mr. Kanzler's new duties include supervision over all operations of the WPB carried out through materials and industry branches.

In January of this year he became chief of the Automotive Branch with

ERNEST KANZLER

headquarters in Detroit, and in March he was made regional director of the WPB office in Detroit. Mr. Kanzler was founder and president of the Universal Credit Corporation until he joined the WPB staff.

INSIDE DETROIT

President bans double-time pay for Sundays and holidays when unrest followed his Labor Day talk. Pirating of labor exaggerated. Half of new workers will be women

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT — Auto management and labor were worried by failure of the President to ban premium pay in his Labor Day talk. Quick to realize the resulting unrest, Roosevelt telegraphed Thomas that forthcoming executive order will prohibit double time for Sunday, but will allow the premium for the seventh consecutive working day.

Last April, in accordance with the President's request, the UAW-CIO agreed to give up overtime pay for week-ends and holidays worked in conjunction with swing shift operations. Accordingly, approximately 80 percent of contracts, covering 600,000 out of 900,000 members, were rewritten, to strike out premium pay for swing shift workers, although not for persons on a straight six or seven days per week.

This action was taken in the light of an alleged AFL-CIO agreement that all unions would give up premium pay. For reasons best known to themselves, the other CIO nation unions and the AFL did not effectuate the agreed-upon policy. As a consequence, the UAW-CIO served notice during its recent convention in Chicago that its locals would be free to re-negotiate the matter of premium pay for swing shift workers if all other labor organizations did not give up, or were required to give up, the plum by September 8.

If all auto-union contracts had been rewritten to foreswear premium pay, the situation would have been easier. In that case automotive labor could have pointed with pride to its sacrifice and let the matter go. But one-third of union members still enjoyed premium pay—notably Chrysler and Ford workers—and this situation created jealousies.

In lieu of premium pay General Motors entered into an interim agreement with the union, under the auspices of the Mediation Panel of the War Labor Board, whereby swing-shift workers are given 20 minutes extra pay per day to stay on the job until the relief man takes over. In the case of production jobs, such as tending a machine, the worker is given 20 minutes pay for what amounts to 6 minutes extra work (the period commonly necessary for the relief operator to take over). On toolroom work, where probably both men can work, the outgoing employee is expected to work the full 20 minutes.

On the average, the General Motors worker is probably better off under the interim agreement than under the premium pay provision in the expired contract.

The question of premium pay had an aspect which was more important to a nation at war than the cost element. In its argument before the National War Labor Board, General Motors said that premium pay is an incentive for the employee to work the premium day and take time off on other days of the working week when he is paid straight time. It is no secret to Detroiters that many skilled and unskilled men have taken one, two, or even three days off during the work week but always showed up at the plant on Sundays and holidays. In fact, time lost per employee, both male and female, has shown a sharp and continuing rise since the beginning of 1942. Recently, absences from work for personal reasons have been at least three times greater than the corresponding period in 1941.

Tool Conference

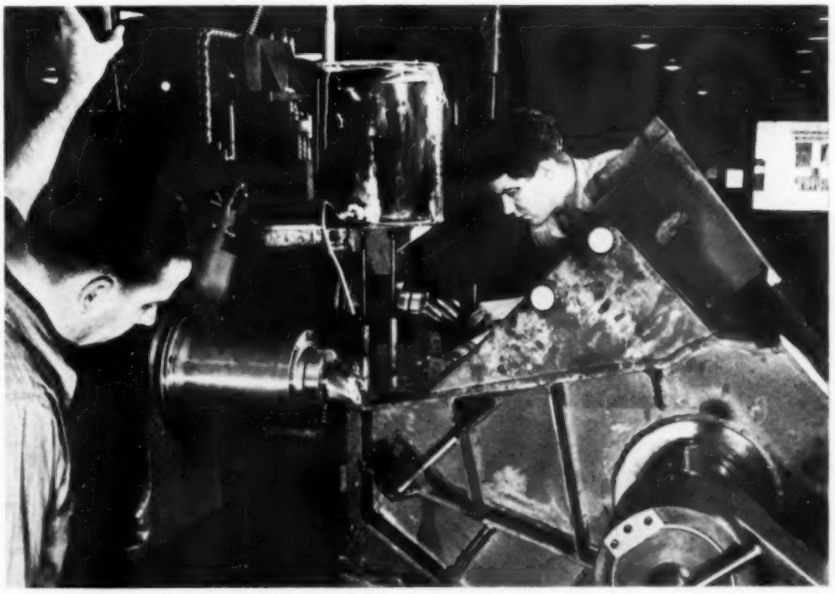
The projected government-management-labor conference to settle the ills of the tool and die industry has been laid over because a survey of auto plants shows that the reputed pirating of labor is a myth. For 118 companies operating 400 plants in Eastern and Midwestern states, the quits in July, 1941, amounted to 2.2 percent of 6321 workers, whereas for the same plants, the quits in July, 1942 amounted to 2.6 percent of 7347 workers. The monthly turnover during the year never surpassed 3 percent, and included draftees and deaths. And strangely enough, quits in Michigan plants, including Detroit, were approximately one-third of one percent per month. These figures scotch reports that the independent tool shops have been pirating labor from the captive, or corporation, tool plants.

Women Workers

Detroit's survey of women willing to work in arms plants yielded results far above expectations. Under the auspices of the United States Employment Service voluntary selective service registration cards were sent to 650,000 women in the Detroit economic area, and 300,000 replies have been received. Statistical analysis of returns indicates that 181,000 women, or 60.3 percent of those reporting, will be available for factory work, as against a hoped-for 80,000, another 36,000 will take non-factory work, and 83,000 are not available at present.

Out of the total reporting, 53,000 women, or 17.6 percent, have had factory experience and are willing to help Uncle Sam. Only 10,000 of this group require outside care for their children in case of war employment.

Between now and the end of the year, fully 50 percent of new workers to be added by Detroit arms plants will be women.



Tailored Machine—Two milling operations are performed simultaneously on this anti-aircraft gun carriage. This machine, designed and built by Ternstedt Manufacturing Division of Fisher Body, adapts heads primarily intended for boring operations, mounts them on a special traversing machine

Some Changes in WPB Staff Expected to Come Gradually

WASHINGTON—There are some personnel shapeups coming in WPB. They will come gradually but will reach to some very high officials. Nelson, unquestionably, has been out of touch with much that has been going on in his organization, is beginning to find out, and is getting mad. However, the resignations that have occurred so far do not constitute any sort of purge.

In the case of the resignation of Amory Houghton the official explanation was for once the right one. He was involved in the anti-trust action against a group of glass companies and it was feared his presence in Washington would prove embarrassing. Reese H. Taylor, chief of WPB's Iron and Steel Branch, and his assistant, R. C Allen, resigned because Taylor was unable to put over a scheme to handle steel distribution on a separate autonomous system independent of the priorities system.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

AUTOMOTIVE PARTS—Manufacturers of such replacement parts may schedule production as if orders received by them had rating of AA-2X. (Amendment 2, Limitation Order L-158.)

ELECTRIC FUZES—Use of copper or its alloys to manufacture parts for fuzes, other than current carrying parts, is prohibited. Assembly with copper parts other than parts carrying electric current is also prohibited. (Limitation Order L-161.)

FARM MACHINERY—Order which granted A-3 rating to manufacturers of farm machinery and equipment has been revoked. (Preference Rating Order P-95.)

HAND - OPERATED TOOLS — Transfer has been made of such tools designed for manufacture, repair or maintenance of aircraft, military vehicles and other predominately military equipment to bring them under provisions of Maximum Price Regulations 136. (Amendment 15.)

HEAT-TREATING EQUIPMENT—WPB is authorized to establish production and delivery schedules in such instances as may be necessary. (Preference Order M-211.)

HIGH ALLOY CASTINGS—Maximum prices at levels prevailing between Oct. 1 and 15, 1941, have been established. (Maximum Price Regulation 214.)

INDUSTRIAL EQUIPMENT—Preference rating necessary to obtain certain types of such equipment has been raised from A-9 or higher to A-1-c or higher, except for Army, Navy, and certain other exempted transactions. (Amendment 1, Limitation Order L-123.)

INDUSTRIAL MACHINERY—Preference rating certificates in the PD-25 (PRP) series and PD-408 (GRP) series may be used by persons covered by the order. (Amendment 3, Limitation Order L-83.)

IRON AND STEEL—These products as defined in the general order as amended do not include salvaged or used materials. (Interpretation 1, Preference Order M-21.)

PACKAGING—No material of any nature to be used for packaging or shipping purposes may be ordered with preference rating assigned under terms of Repair, Maintenance and Operating Supplies Order P-100. (Amendment 3.)

PRP RERATING—Companies operating under PRP must not use rerating provisions of the order to expedite delivery of materials for improvement, expansion or construction of their own plants. (Interpretation 1, Priorities Regulation 12.)

RUBBER—Consumption of crude rubber, latex, reclaimed and scrap rubber in all civilian products is not permitted except on specific allocations. (Supplementary Order M-15-b.)

SAW BLADES—Sale and distribution of metal cutting band and hack saw blades are limited to consumers with preference ratings of A-9 or higher. (Preference Order E-7.)

SHOT STEEL—Revocation of Supplementary Order M-21-f has been made. Allocation of this material will be carried on under M-21-a.

SILVER—Restrictions on putting this metal into process apply only to first processing. (Interpretation 1, Conservation Order M-199.)

TERNEPLATE—Manufacture or use of such oil cans except for sale to government agencies is prohibited. (Supplementary Order M-81-b.)

Decline in Liberty Ship Delivery Was Not Serious

WASHINGTON—Delivery of 68 Liberty ships in August, three less than in July, is not too disappointing when one examines the facts. Officials of the Maritime Commission tell AMERICAN MACHINIST that there was delay in deliveries of steel sheet and shapes at some yards. But other factors contributed more importantly to the slight decline in ship output instead of the expected continuation of the upcurve swing.

Chief among these factors is one that must be held down to generalities in the interest of security. Five merchant ships that would have been delivered for inclusion in August totals were turned over to the Armed Forces for certain conversions, which set them back for later completion.

Reports that adoption by some yards of the speedy Kaiser methods had temporarily slowed them are tagged false by the commission. Officials say that Kaiser is good, he has the drive and the know-how, but speed-up methods of shipbuilding are no more his than they are other contractors. Word has come to Washington that one of Kaiser's tricks is to keep swarms of men around, ready to throw into any breach. Of course he cannot do that when spare labor is all gone.

Construction Phenomenal

Ship construction speed-up is really phenomenal. Time from keel to delivery has come down from 241.3 days in January to 83.3 days in August. This is roughly one third of the original time schedule. You now have reason to expect a ship per month per way.

Kaiser's Oregon average for August was 50.2 days per ship. In one of his Richmond, Calif., plants his average was 77.1 days and in another it was 99 days. Meanwhile, California shipbuilding averaged 61.3 days and Bethlehem 61.7 days in the same month. These figures show that Kaiser has already been beaten in two of his yards. You need not be surprised if some yard beats his 46-day championship some time soon.

There's nothing mysterious about the methods by which these shipbuilding records are accomplished. Builders simply divide the ship in major sections—the biggest that can be moved—build the subassemblies, then fasten them together. They used to swing single plates into place, and they had swarms of men, all over the ship, getting in each other's way. The new philosophy is to spread out in plenty of room, build your major elements, and then let a few men do the final assembly.

It is interesting to note, in this connection, that Boeing Aircraft Company has divided its B-17 assembly line into seven parts (see page 1042k), using approximately the shipyard method for airplanes.

WARTIME WASHINGTON

Full impact of war production approaches—cost will top total 1929 national income. President's wage program is vague; labor's influence in Washington is growing again

BY BLAINE STUBBLEFIELD

WASHINGTON—Full impact of the war production program is at hand to an extent not yet realized by most industrialists. A survey of the overall figures gives an idea of how completely the country is engaged now in producing war goods. The shift from getting ready to manufacturing on a huge scale has come fast in the last two months. Around the end of the year the volume will be close to the peak it is estimated can be maintained. The absolute top is expected to be reached late in the spring of 1943.

Less than $25 billion was spent for all war purposes up to the end of last June, or in 25 months. Around half of this outlay was for plant, facilities and various needs other than actual weapons. Last month close to $5 billion was paid out for war costs, most of which was for production of war goods.

By the end of the year the monthly outlay will be about $6 billion. Of this, about 75 percent will be for production. The percentage may be considerably higher, if construction of incompleted plants is stopped to any extent.

When Peak Output Comes

When the war effort attains a peak of $85 billion a year before the middle of 1943, the money will be spent almost entirely for weapons and supplies. The national income was $81 billion in 1929. What effect a war production total in excess of the previous annual gross income of the country will have is problematical. Whether such a tremendous output can be maintained is seriously questioned in Washington. WPB planners are confident that it can be. Recent materials shortages, with production far below the maximum planned, arouse doubts of ability to hold on the high plateau expected to be reached late next spring. WPB people say that there is enough material in all except a few lines to do the job. But they assert that far closer control over the use of practically all materials, services and facilities must be exercised than the public now realizes. That is one reason why WPB has taken over completely the flow of materials and has relieved the armed forces of authority to say who gets what.

Really essential civilian services and production will get enough to maintain operations. Several WPB industry advisory committees have learned in the last week or two that expansion of any kind is out. But WPB is going to do all it can to maintain those activities that really are necessary to keep war production at the highest possible levels. But from here on war definitely comes first, and to an extent that few seem to realize.

WPB will get a lot tougher with industry than many in industry will like.

The plans to take drastic steps to balance production were made weeks before the recent country-wide outburst that Nelson "get tough." These plans will bring unpleasant surprises to many concerns with war contracts, as well as to those engaged in civilian production and services. Mr. Nelson meant what he said recently that the armed services and other government agencies are working for him. That will soon become evident, as WPB takes over direction of the production program. WPB engineers in each of 400-500 prime contractors' plants will determine what work may proceed and what will be slowed down or stopped. These engineers also will have full authority to decide what inventories may be carried. In some instances excessive inventories will be shunted to plants which are short. All inventory positions are going to be much tighter.

Lend-Lease Advisor — Maj. Gen. Charles M. Wesson, former Chief of Ordnance, has been appointed an assistant to the Administrator, Office of Lend-Lease Administration. He will assist on reciprocal transfer of military supplies as well as on general matters of policy

Wage Stabilization

Both the President and Congress are dealing very gently with the wage-stabilization aspect of the new inflation-control program. Roosevelt barely mentioned wage stabilization in his speech and Congressional message—statements in which he got very tough-sounding about the farmer. Congress is contenting itself with legislation which, in effect, simply indorses the President's wage program. This points to an expansion of the War Labor Board "15 percent" policy. Particularly interesting is the move to sweeten even this with extension—chiefly significant after the war—of the wage-hour law to groups not now covered. This is the same Congress which, only a year ago, came close to nullifying this law.

Since Sidney Hillman was bounched out of the old OPM last winter, labor influence in Washington has not been obvious. But it's been active behind the scenes. Its power and prestige here is growing, and now it's beginning to come back on the front of the stage.

Potentially of great significance are Donald Nelson's concessions to labor demand for representation in WPB. The concessions are vague, but their very vagueness opens the way for labor, if it knows what it wants, to expand them into something important. Two WPB vice-chairmanships are to be granted to labor. They will not, initially, carry any specific powers or even any specific duties. But if strong men get the jobs (Walter Reuther or Clinton Golden are possibilities) they'll be important posts. Armed with an impressive title, the labor men can lean over any WPB shoulder, can watch developments from the inside, will have the perfect platform from which to talk to the public, to Nelson, or to the President.

Many labor leaders prefer such a floating kidney arrangement as this, believing that assignment of definite duties would quickly submerge any labor man into the WPB bureaucracy. They point to Hillman's experience.

A distinct change in the character of the Production Drive's labor-management committees is to be expected as a result of Nelson's agreement to turn over the operation of the drive to a new five-man group made of two men each from labor and management and a government chairman. Entire emphasis in the Washington guidance given the plant committees so far has been put on propaganda and morale work. Union pressure to inject the committees into production planning will now be felt at the top.

Canada's Trouble With Manpower Controls; Poor Reception for First Pay Deduction

OTTAWA—Prospects are slender for the redress of war plant grievances arising out of Canada's new selective service and manpower control order. To sweeten worker control restrictions for labor, Labor Minister Mitchell underscored restrictions on employers and some of these are proving in practice to be a serious handical on war plant operations, but Mitchell is afraid that the granting of relief would stir resentment among labor unions.

The principal complaint is against the provision requiring seven days' notice before laying off or discharging employees. This provision was designed to balance the requirement that workers must give similar notice before quitting jobs. One effect is to virtually bar layoffs when plant operations have to be suspended owing to slow delivery of materials or a breakdown of machinery. Workers made idle by the suspension have to be kept on the payroll during the notice period. The order also prevents the release of incompetent workers without the seven days' notice. A plant taking on a man on his own statement of qualifications and finding that statement to have been a misrepresentation cannot get rid of him for a week.

Interference With Repair

Restrictions in the selective service order are also interferring with service operations of companies responsible for the adjustment and repair of machines. Example: an electrical machinery company which has a call to repair a piece of equipment supplied by it can only hire repairmen recommended by the local selective service office if the work is to last more than three days and must give a week's notice of dismissal.

Representations from war plant heads looking to modification of the restrictions have had a cool reception in Ottawa, due largely to a greater restlessness among war industry workers than at any time since the war started. The demand of U. S. labor for equal representation with industrialists in the control and direction of war production is paralleled in Canada. Canadian Trades and Labor Council formalized labor's claim at its annual convention in Winnipeg when it demanded equality of representation on all war boards. Canadian Congress of Labor, C.I.O. affiliate, is making the same demand.

Threatened Steel Strike

The threatened strike in primary steel plants at Sault Ste Marie and Sydney, Nova Scotia, has been averted by a concession to United Steel Workers. The claim of U.S.W.A. was for a boost in the basic wage rate from 46½ to 55 cents and the Regional War Labor Boards had rejected it. Labor Minister Mitchell has appointed a government commission to probe the whole labor situation in the steel industry. This backdown followed Prime Minister Mackenzie King's declaration that the government would not interfere with the War Labor Board.

Ottawa is still jittery about labor's reception of the first deduction from pay envelopes for income taxes. Finance Minister Ilsley, however, has softened the situation by a face-to-face appeal to war plant workers. He has spent three weeks visiting plants in the principal war production areas.

Power Shortage

Essential industry faces an electric power shortage of between 250,000 and 300,000 hp. in Ontario and 100,000 hp. in Quebec, which will reach a peak in November and December. It is being met initially by a heavy transfer of power from the paper industry. In the Niagara district five paper plants will have their power supply cut by 50 percent October 1 and will be allowed to continue in operation at half of their capacity only until they exhaust wood supplies now on hand. Paper plants in other power areas—Ottawa, Saguenay and St. Maurice River districts—will be treated similarly. Customers in Canada and the U. S. of the restricted plants will be supplied by plants in areas where the power shortage is not acute or where the power cannot be transferred to main power systems. Other less essential industries will have their power supplies reduced.

Electric steel furnaces face a severe shortage of material during the winter unless a current drive for scrap collection brings results. An effort is being made to bring in all accessible iron scrap before snow comes.

STAND BY: WORKER PICK-UP

LONDON—Evidence collected by the B.B.C. shows that the skilled worker derives considerable benefit from listening to music while he is working, especially where the work is repetitive and largely automatic. Output is increased and monotony counteracted if the worker is induced to sing or whistle in accompaniment. Broadcasts are made for thirty minutes twice daily and the most suitable music has been found to be familiar tunes of dance music, light opera, musical comedy, popular marches and intermezzi. "Hot" music and vocal music cause distraction, as well as volume of sound. It is desirable to avoid the higher and lower octaves and follow more closely a middle course.

East Indies Trainer—Ryan STM trainers fly above native rice paddies over the Dutch Indies. Reports from a returned pilot indicate that they did every possible job as military ships except gunnery and bombing training during the year prior to Japanese invasion

Two Former WPB Men, Three Used Tool Dealers Indicted

WASHINGTON—Two former War Production Board officials, Robert B. Rhoads and Ralph L. Glaser, and three dealers in used machine tools, Louis E. Emerman, Frank L. O'Brien, Jr., and Clarence J. O'Brien, have been indicted by a Federal Grand Jury and charged with conspiracy to defraud the United States and with interference in the prosecution of the war.

Mr. Rhoads joined the WPB in January, 1942, and was later placed in charge of the Available Used Tool Section of the Tools Branch. Mr. Glaser, who was formerly connected with the British Purchasing Commission as a technical advisor in procurement of used machine tools, joined the WPB in January also as assistant to Mr. Rhoads.

The indictment charged that both men conspired with Emerman, a Chicago used machine tool dealer, and the two O'Briens, Philadelphia machine tool dealers, to prevent critically required machine tools from being allocated to war contractors. In addition, Rhoads and Glaser have been charged with selling at a profit of $30,000 to themselves an option on used machine tools they received from Emerman, who made no report to WPB or OPA of the existence of 71 used machine tools which he owned. In June, Rhoads and Glaser transferred the option to Clarence J. O'Brien and Frank L. O'Brien, Jr., for $30,000.

The indictment alleges that as a result of the conspiracy vitally needed machine tools having a market value in excess of $150,000 remained idle for more than six weeks since no report of their availability was made.

Boeing Special-Built Tools Conserve Time and Space

WASHINGTON—Nearly 100,000 special tools of all kinds have been designed and built by Boeing Aircraft since the war emergency began. This figure does not include standard types of tools purchased, such as motors, drilling motors, pneumatic hammers, riveting machines, die sets, presses and others—all used in production of the Flying Fortress B-17.

Among the special tools is a circumferential hydropunch which performs 19 different punching operations at one time, making V slots in circumferential stiffeners—metal ribs that encircle the plane's fuselage. Another is the automatic aluminum spot welding table. It makes 62 automatic spot welds per minute, traveling a half inch at fractional-second intervals and pausing 0.8 second for each weld.

Boeing's tooling, and its new "production density" system which makes maximum use of tools and space and manhours, are largely to credit for the company's winning of the Army-Navy Production "E" award. Production density means that the assembly line has been eliminated and replaced by seven distinct major assembly operations on as many major parts of the plane. These parts are then joined quickly in a final assembly jig. It puts an end to the loss of efficiency where swarms of men get in each other's way on a long line assembling complete planes.

Washington Appointments

WPB, Industry Advisory Committees:

Presiding Officers: N. G. Burleigh, Calculating Machine Manufacturers; K. W. Ostrom, Electrodes and Rods Manufacturers; John Gammell, Knife and Enclosed Switch; C. R. Heller, Conveyor and Mechanical Power Transmission.

WPB, Miscellaneous:

Ernest Kanzler, director general for operations; J. Tucker, director, Canadian Div., Office of Operations; Daniel J. Hutchins, regional director, Detroit; David F. Austin, deputy chief, Iron & Steel Branch; Joseph L. Weiner, chairman, Committee on Concentration of Production.

Office of Price Administration:

C. D. Scully, Jr., chief, Scrap Section of Iron & Steel Branch.

BUSINESS ITEMS

Giddings & Lewis Machine Tool Co. has appointed four companies to handle its complete line in the New York and New England territories formerly covered by Henry Prentiss & Co. Wilson-Brown Co., Chrysler Bldg., New York City, will represent the company in the northern New Jersey, Connecticut and eastern New York State territories, while C. H. Briggs Machine Tool Co., Syracuse, N. Y., will cover central New York, and George Keller Machinery Co., Buffalo, N. Y., the western New York section, including the Buffalo and Rochester territories. Wigglesworth Machinery Co., Cambridge, Mass., will handle the states of Maine, New Hampshire, Vermont, Massachusetts and Rhode Island. Giddings & Lewis Machine Tool Co., has also established an office in the Chrysler Bldg. adjacent to the Wilson-Brown Co. where D. M. Laflin will make his headquarters and continue to serve through the above concerns as well as through the Swind Machinery Co., Philadelphia, and Tidewater Supply Co., Inc., of Norfolk, Va.

Tubular Products, Inc., subsidiary of United States Steel Corp., has been changed to Tubular Alloy Steel Corp.

Delta Mfg. Co., Milwaukee, has been sold by the Timken-Detroit Axle Co. to a partnership headed by Marshall Field of Chicago. Associated with Mr. Field will be H. Campbell Stuckeman of Pittsburgh, who will be in charge of the plant, and Charles G. Cushing of New York.

Carbide Fabricators Co. has been formed with William S. Morse, Marion J. Morse, Marion Morse Corkery and William H. Morse as copartners. This company assumes the contracts and other obligations of the Carbide Fabricators Div. of Morse Tool Co.

Mathewson Tool Co. has been organized with offices at 1200 Niagara St., Buffalo, N. Y., for production of tools for aircraft and general manufacturing and development work. It is headed by C. D. Mathewson, formerly branch manager and chief tool supervisor of the Duncan Tool Designing Co.

The Vacuum Tube Div. of the radio, television and electronics department of General Electric Co., will hereafter be known as the Electronic Tube Division.

Lennox Furnace Co. has purchased the plant of Steiner Bros. and it will be known as the Steiner Div. of the company.

Barden Corp., an affiliate of Carl L. Norden, Inc., has acquired a plant at Derby, Conn., for the manufacture of precision instruments.

NAMES in the NEWS

Wallace T. Montague has been advanced to vice president of Norton Co. He has charge of sales planning and development and has held the position of assistant vice president. Mr. Montague is chairman of the directors of the Grinding Wheel Manufacturers Assn. and vice president of the Special Refractories Assn.

Howard S. Welch has been appointed president of Eisemann Magneto Corp. In addition to his present duties Mr. Welch will serve as director and president of Airward Corp., which is engaged in the development of special duty magnetos for aircraft engines.

William A. McKinley, formerly chief sales engineer of Midland Steel Products Co., has been named vice president in charge of manufacturing and sales. He has been associated with

Kropp Project Manager

J. E. WHITE

Hydraulic Executive

C. J. KENNEDY

Fostoria Director

W. S. CRANDALL

Mid-West Sales Manager

F. A. SHARPE

the company since its organization, with the exception of a brief period when in his own business. Mr. McKinley had charge of manufacturing at the Detroit Pressed Steel Co. which became a part of the present firm in 1923.

J. H. Lund, for the past several years in the Kropp Forge Co. sales organization, has been appointed vice president of the new subsidiary known as Kropp Forge Aviation Co. J. E. White has been named project manager in charge of construction of the plant.

Willard S. Crandall has been made director of engineering of Fostoria Pressed Steel Corp. Recently he has been handling product development activities at the plant.

Carl J. Kennedy has been appointed assistant secretary and assistant treasurer as well as sales manager of Hydraulic Machinery, Inc. Until recently Mr. Kennedy was sales manager of the McAleer Co.

Emil F. Klein has been named treasurer of Casco Products Corp., Bridgeport, Conn. Mr. Klein has been connected with the company for 13 years.

Roy M. Smith has joined the Roller-Smith Co., Bethlehem, Pa., as assistant chief engineer. Prior to this connection he was with the Bryant Electric Co. and Westinghouse Electric & Mfg. Co.

George T. Jones has been appointed chief metallurgist of the Homestead Steel Wks. of Carnegie-Illinois Steel Corp. After several years with the Allegheny Steel Co. he became connected with the Homestead Wks. in 1937.

W. J. Reagan has become melt shop research metallurgist of the Copperweld Steel Co. He is vice chairman of the Iron and Steel Div. of the A.I.M.E.

R. J. Laidlaw has been named manager of the Cleveland district office of Worthington Pump and Machinery Corp. Mr. Laidlaw has served the company in various capacities since 1919.

G. F. Ahlbrandt, assistant vice president of the American Rolling Mill Co., has been appointed civilian chairman of the Armor Plate Production Committee recently formed by the Tank and Motor Transport Branch of the Ordnance Department.

Frank A. Sharpe has been promoted to sales manager of the Mid-West Abrasive Co. He has had extensive experience in the automotive field, having been connected with Packard Motor Car Co., the Winton Co., Pierce Arrow, White Co., General Motors Corp. and others.

James R. Beers has been named manager of the Milwaukee sales office of Scully Steel Products Co.

OBITUARIES

Edwin L. Smalley, 65, president of the Hevi Duty Electric Co., died in Milwaukee recently. He was a pioneer in the electric heat-treating furnace industry and held many furnace patents.

Thomas S. Grasselli, 67, who retired from active business in the chemical industry four years ago, died at his home of a heart ailment. He was president of the Grasselli Chemical Co. for 20 years, and vice president and member of the executive committee of E. I. duPont de Nemours & Co. when the firm became a subsidiary of duPont.

Reginald D. MacDonald, 45, vice president and treasurer of the American Swiss File & Tool Co., died after a short illness. Mr. MacDonald was associated with the company for 12 years.

William S. Gilmour, 58, superintendent of Blake & Johnson Co., Waterbury, Conn., passed away suddenly. He began as toolmaker with the company 35 years ago.

Harold C. Ryder, 49, advertising and sales promotion manager of the Hayward Co., died suddenly at his home. Mr. Ryder was connected with the firm for the past 35 years.

MEETINGS

American Management Association. War Manpower Conference. Hotel Pennsylvania, New York City, Sept. 29-30.

Society of Automotive Engineers. National Aircraft and Production meeting and Aircraft Engineering Display. Biltmore Hotel, Los Angeles, Calif. Oct. 1-3.

National Safety Council, Annual meeting. Chicago, Ill. Oct. 5-9.

National Metal Congress and Exposition. War Production Edition. Cleveland Public Auditorium. Oct. 12-16.

American Welding Society. Annual meeting. Hotel Cleveland, Cleveland, Ohio. Oct. 12-16.

American Gear Manufacturers Association. Semi-annual meeting. Skytop Lodge, Skytop, Pa. Oct. 15-17.

American Society of Tool Engineers. Semi-annual meeting. Kimball Hotel, Springfield, Mass. Oct. 16-17.

Wire Association. Annual meeting. Detroit-Leland Hotel, Detroit, Mich. Oct. 19-23.

National Electrical Manufacturers Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Oct. 26-30.

Industrial Hygiene Foundation. Annual meeting. Mellon Institute, Pittsburgh, Pa. Nov. 10-11.

National Founders Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Nov. 18-19.

National Exposition of Power and Mechanical Engineering. Grand Central Palace. Nov. 30-Dec. 5.

SHOP EQUIPMENT NEWS

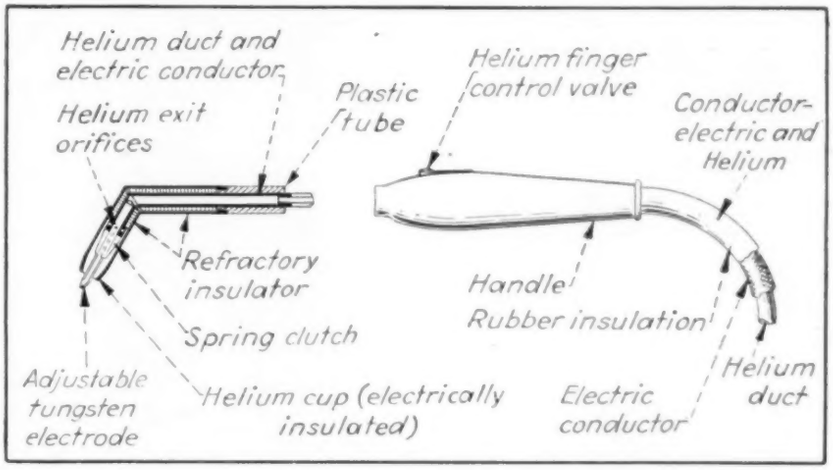
Heliarc Welding Process Developed by Northrop Aircraft Can be Used for Welding Magnesium and Stainless Steel

A new method of arc welding developed by Northrop Aircraft, Inc., Northrop Field, Hawthorne, Calif., permits the welding of magnesium sheets, extrusions and tubing into structures simpler, lighter, and stiffer than is possible in conventional duralumin construction. At the same time methods of treating magnesium to make it less inflammable and more resistant to heat have been perfected.

Magnesium castings containing foundry defects have been repaired with this process, which is known as "Heliarc Welding", and welds equal to or stronger than the surrounding metal have been obtained. The weld metal is more dense than that of the surrounding cast metal and is far less susceptible to corrosion. Almost any thickness of cast metal that can be poured may be welded by using this method.

In the heliarc welding process, a shield of helium gas envelops the molten metal. Because helium gas is an inert gas, it prevents oxidation and eliminates the use of a flux and the danger of entrapped flux in the weld ingot that would promote corrosion. The arc in this process is produced directly between a tungsten electrode and the base metal rather than between two tungsten electrodes as is customary in atomic hydrogen welding.

The welding torch is equipped with a helium valve that is opened just prior to the striking of the arc between the tungsten and the parent metal. Helium has over five times the specific heat of air and when in motion prevents heat accumulation around the weld, thereby keeping it cooler and giving a better fusion and penetration with less distortion.



The heliarc welding torch is used in conjunction with a magnesium rod. The torch is provided in two sizes and with three tip angles

In heliarc welding the molten metal is enveloped in a shield of helium gas. The tungsten electrode is very slowly alloyed with the weld metal and the electrode must later be replaced

The torches are of two sizes to handle 1/16-in. to ⅛-in. electrode and 3/16-in. to ¼-in. electrode respectively. They may be supplied with tips of 40, 60, and 90 deg. The torch may be used for pencil welding or, by extending the handle, a handle-bar grip is obtained for heavier welding. A type of torch will later be available that feeds the filler rod automatically, giving more uniform results than where the rod is fed by hand. Best results are obtained by feeding the filler rod into the tungsten electrode which melts off portions of the rod thereby casting a uniform weld ingot.

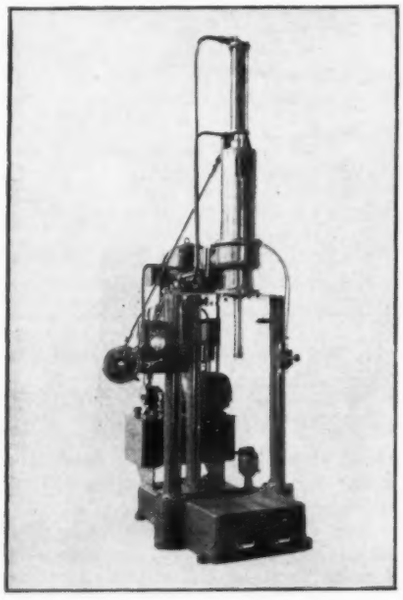
A conventional arc welding machine with direct current generator having a 150-amp. output is desirable. However, higher output machines which operate at less than 300 amp. may be used providing lower amperage may be obtained. An upright machine is preferable in that it is easier to attach a helium tank to such a unit. Separate amperage and voltage regulators must be provided and the machine should have a continuous sequence of five increments of current control. The aver-

age life of a 200-cu. ft. helium tank is about 35 hours of continuous welding with a medium-sized torch.

This method of arc welding has provided an important new tool for the fabrication of structures from stainless steel as well as magnesium. Any type of joint which has been commonly used for welding ferrous metals, may be employed.

Hi-Speed Honer and Lapper Performs Wide Range of Work

Designed for honing cylinders up to 24 in. in diameter with strokes from 20 to 72 in. the Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., N. Chicago, Ill., has announced the Hi-Speed honing and lapping machine. It has been made for use with any standard make of honing head and handles a wide range of work involving the internal finishing of such parts



as aircraft cylinders, connecting rods, gun barrels, landing gear struts, recoil and recuperator cylinders, all types of internal combustion engine cylinders, diesel engine liners and supercharger parts.

All controls are located at the front of the machine at the operator's station. The machine is quickly adjustable for different jobs. Provision is made for an ample supply of coolant to be carried to the hone head to keep the honing stones clean and carry off the abrasive and metal particles accumulated by honing. The sludge pan receiving most of the residue can be removed from the front for cleaning without loss of coolant from the chambers or reduced production through "down time" for tank cleaning. The coolant is delivered to the work by a large capacity motor driven pump. Fifteen ball and roller bearings are used in the drive train.

The Hi-Speed machine is available in four standard models, any of which can be had with strokes up to 72 in. with any distance under the spindle nose to suit requirements.

Michigan Tool Finisher Designed for Small Gears

Rapid finishing of small gears by the crossed-axis principle of gear shaving, is possible with the new finishing machine, the 861-4B, produced by the

Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich. The machine is designed for finishing gears of less than 4 in. diameter and less than 1 in. face width. In operation, the gear, which may be mounted on a specially designed mandrel or on its own shaft, is placed between dead centers with hard metal tips in the machine. The serrated-tooth rotary cutter, mounted on an axis at an angle to that of the gear, engages and drives the gear, first in one direction and then in the opposite direction, to finish both tooth faces. During the cutting action and in feed, the cutter also reciprocates back and forth across the face of the gear, permitting the use of narrow cutters.

Both the cutter cross-feed and the infeed to the correct center distance are cam-controlled.

Howe Compact Drill Grinder Built for Small Capacity

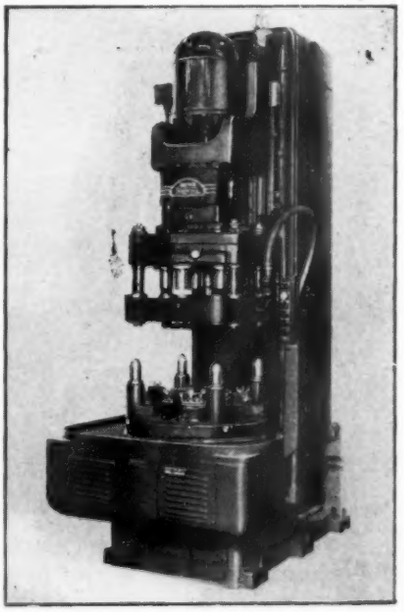
A compact, motor driven twist drill grinder has been introduced by Howe and Son, Inc., Hinsdale, N. H., with capacity of 1/16 to 1¼ in. drills, provision being made for larger drills if desired. The grinder takes ½ hp. 220 volt, or 1/3 hp. 110 volt motor and has two 6 in. wheels. One wheel is used for drill grinding and the other

for general work. There is a compartment contained in the base of the machine with shelves for tool storage.

Special Features Included In Snyder Standard Driller

A 10 V 18 general utility standard drilling machine with many features of a special machine has been announced by Snyder Tool & Engineering Co., 3400 E. Lafayette St., Detroit, Mich. It has a capacity up to 15 hp., 1800 r.p.m. for driving tools. The maximum stroke is 18 in. and the opening between the base and the speed change transmission is 36 in. minimum, 56 in. maximum. This unit is equipped for hollow milling 20 bosses using a 5-spindle head, and the fixture indexes four times to complete the work. The hydraulic oil is contained in a reservoir mounted on top of the column. The hydraulic pump, motor and counterweight to balance the hand slide and multiple head are housed inside the column.

This machine is available with or



5 Ways to Get Faster Deliveries of *Special* Carboloy Tools and Blanks

A "special" Carboloy tool or blank is one made to special shape, size, tolerance or grade. Any one or all of these requirements—means a "special". It requires special handling apart from our regular production line of standards. To help you get essential specials with a minimum of delay and expense, we list below 5 suggestions to follow when ordering.

BUT—before you order—check your needs against Carboloy Standard Tools & Blanks. Produced and placed in stock by the thousands daily, Carboloy Standards are suitable "as is"—or adaptable by grinding—to 80% of all turning, boring, facing jobs. In this crucial period when every minute counts, you can usually save 6 to 8 weeks delivery by ordering standards instead of specials whenever possible.

FIVE POINTS TO CHECK WHEN ORDERING "SPECIALS"

1. Follow these suggestions when specifying tolerances—

(a) Be *sure* your tolerances are as liberal as job will permit.

(b) Specify tolerances on all decimal dimensions.

(c) Use our standard tolerances whenever possible. These are:

STANDARD TOLERANCES

TOOLS		BLANKS	
Shank Width and Height	Finished Tools / Milled and Brazed Tools	Blank Dimensions	Tolerance
1″ and less	+.000; −.010 / +.000; −.015	Up to 3/8″	+.015; −.000
Over 1″	+.000; −.015 / +.000; −.015	3/8″ to 1″	+.020; −.000
		1″ to 2″	+.040; −.000
Shank Length:		2″ to 3″	+.060; −.000
4 1/2″ and less	+ 1/16; − 1/16	3″ to 4″	+.080; −.000
4 5/8″ to 7 1/2″	+ 1/8; − 1/8	4″ to 6″	+.100; −.000
Over 7 1/2″	+ 1/4; − 1/4	Over 6″	+.125; −.000

2. Specify the following stock sizes of shank steels:

1/4″ square	5/8″ square	7/8″ square	5/8″ x 1 1/4″	1″ x 1 1/2″
5/16″ square	1/2″ x 3/4″	5/8″ x 1″	3/4″ x 1 1/2″	1 1/4″ x 1 1/2″
3/8″ square	3/4″ square	3/4″ x 1″	1″ x 1 1/4″	1 1/2″ square
1/2″ square	1/2″ x 1″	1″ square	1 1/4″ square	1 1/2″ x 2″

3. Design tools to use standard blanks. They are carried in stock.

4. Use the same standard relief and rake angles that we use on our standard tools. Our manufacturing facilities are set up to produce these angles rapidly. (Send for catalog GT-142.)

5. Furnish at least two (preferably three) sets of blueprints on all special orders. This eliminates delays for duplications of prints.

The Mark of CARBOLOY

CARBOLOY COMPANY, INC.

11149 E. 8 MILE BLVD., DETROIT, MICH.

Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh

Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

Order "Specials" When They Are Essential . . .

BUT . . . whenever possible use Carboloy STANDARD tools and blanks . . HERE'S WHY:

Carboloy Standards are in "mass" production. Shipped from stock. No delays for drafting, quotations or special ordering. You save 6 to 8 weeks delivery time.

You can quickly and easily torch braze standard blanks to your steel shanks in your shop. . . . Tool up rush jobs *FAST!*

You can quickly grind standard tools to special shapes. Carboloy standards are adaptable to 80% of all turning, boring, facing jobs.

CARBOLOY CEMENTED CARBIDES

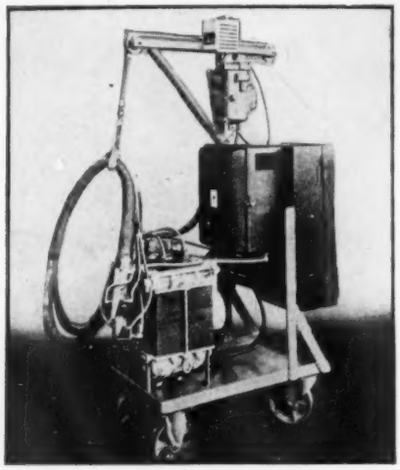
TOOLS • DIES • DRESSERS • CORE BITS • MASONRY DRILLS • WEAR RESISTANT PARTS •

FOR THE MANUFACTURING • MINING • TRANSPORTATION • CONSTRUCTION INDUSTRIES

without special tooling and speed change transmission for single or multiple spindle adaptations. By simply changing the special equipment only it can be retooled for entirely different production.

Progressive Welder Hydraulic Gun Has Adjustable Stroke

A gun designed for welding brackets or clips for light-gage alloy steels has been introduced by Progressive Welder Co., 3050 E. Outer Drive, Detroit, Mich. The gun operating pressure is hydraulic with partially counter-balancing continuous air pressure. The latter also serves to automatically retract the

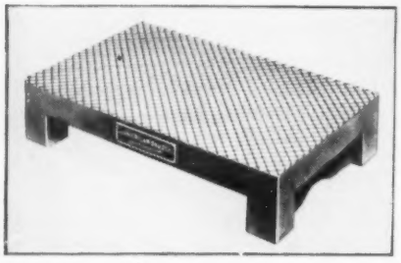


points when hydraulic pressure is released, thereby simplifying operation.

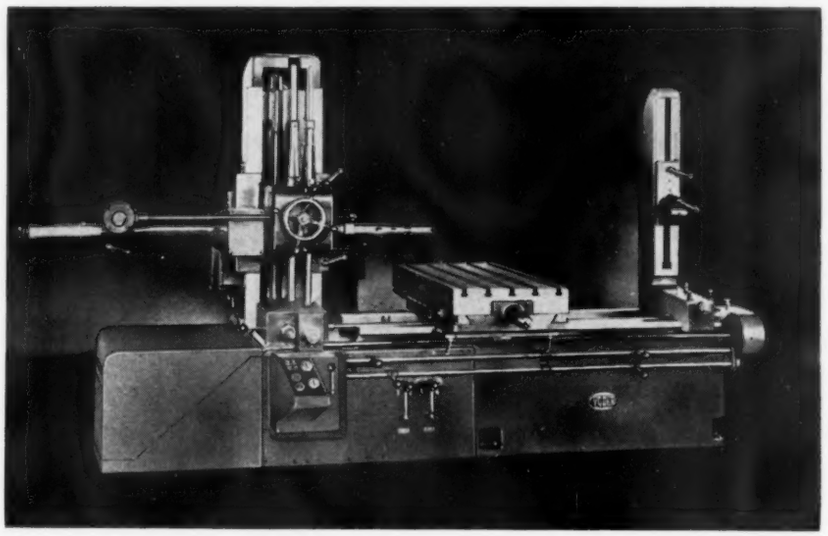
The gun has a screw-adjustable stroke (up to 3 in.) to take care of a wide range of work sizes, quick interchangeable adapters for electrodes to make the gun suitable for a wide variety of work shapes.

American Gauge Lapping Plate Has Grooves in Diamond Pattern

A precision lapping plate has been announced by the American Gauge Company, 128 Bayard St., Dayton, Ohio. The plate is 8×12½×2½ in. The cast iron block is of especially fine grain cut with 1/16-in. grooves in a diamond pattern. The lapping plate surface is first ground and then lapped until it is accurately flat and the grooves are cut deep so that surplus lapping compound will not accumulate on the plate surface.



Yoder Horizontal Boring Mill Adopts Power Touch Control

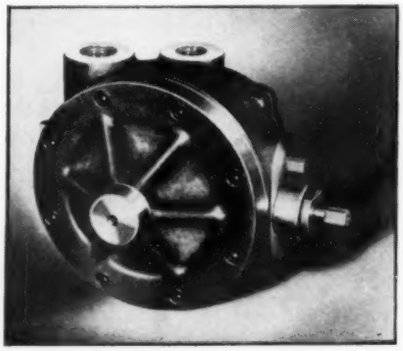


Among the advanced features of the new 3A horizontal boring mill introduced by the Yoder Co., 5500 Walworth Ave., Cleveland, Ohio, is the power touch control in which the touch and turn of the hand control replaces gear shifting levers. This power flow speed change embodies high acceleration, quick dynamic stops without shock or strain to machine parts. The touch control causes the positive power flow drive to put every allowable amount of power on the tool and the feeds may be set to a maximum without limitations of step gears. Speed variation on the spindle and feed is 16 to 1.

The head, column and outer support are equipped with syncronized vernier scales and all hand adjustment screws are equipped with screw lock micrometer dials. All controls are centrally grouped and starting, stopping and reversing of machine and feed are controlled through two bars running along the front of the machine. A two-speed rapid traverse facilitates inching up to the work at a slow rate or at a high rate when considerable travel must be made. Infinite speeds up to a maximum of 600 r.p.m. on the spindle may be obtained and 100 in. per min. on feed for head, saddle and table.

Hydra-Motive Makes Vane-Type Pumps Available for General Use

The Hydra-Motive vane-type pump, originally designed exclusively for use with the Duplimatic, has now been made available by Hydra-Motive, Inc., 253 St. Aubin Ave., Detroit, Mich., as a



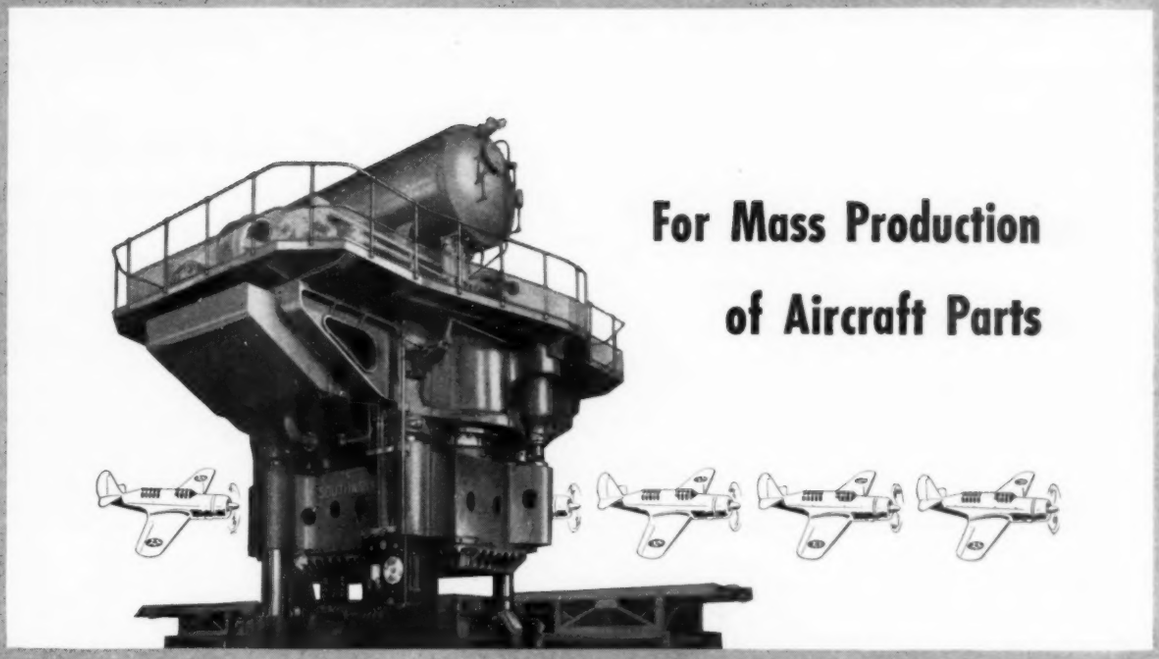
replacement for existing pumps or as new equipment. The adoption of a mounting permits the pump to be used without changing current designs. Delivery is infinitely variable from 0 to 4 gal. per min., and the operating pressures are 1,000 lb. per sq.in. with a short-interval maximum of 3,500 lb. per sq.in. An additional feature is the unique method of balancing the individual vanes. Being bevelled on two edges, as well as the outer side, the result is a noticeable reduction in wear, elimination of over-heating and increase in operating efficiency.

A split stator instead of the conventional solid ring is employed to permit maximum selection of adjustment. Adjustment and limit screws on the outside of the housing allow for varying the delivery to any amount required within the operating range.

General Electric Equipment Uses Heavy-Coated Electrodes

Complete equipment for automatic arc welding with heavily coated electrodes in cut lengths has been brought out by General Electric Co., Schenectady, N. Y. It is particularly suited to work where one or more complete joints can be made with a single electrode such as in the welding of shells, wheels, machine gun water jackets and tubular assemblies where the starting and finishing ends of a single weld bead overlap.

The mechanism of the equipment in-



For Mass Production of Aircraft Parts

. . . install Baldwin Southwark Hydraulic Presses

Helping the aircraft industry "get 'em in the air" Baldwin Southwark hyspeed hydraulic presses feed a steady supply of parts to the assembly floor. Southwark hydraulic presses maintain high production rates and prolong the life of the dies. Die set-up and changing time have been sharply reduced. Delays caused by breakage of dies and press members are gone. Pressed pieces hold their shape—spring-back is out.

Southwark has built scores of presses ranging from 100- to 5,500-ton capacity that have taken their places on aircraft production lines. Southwark hyspeed hydraulic presses can help you do a better job—faster. Write today for our Bulletin K-160.

Baldwin Southwark Division of The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco, California.

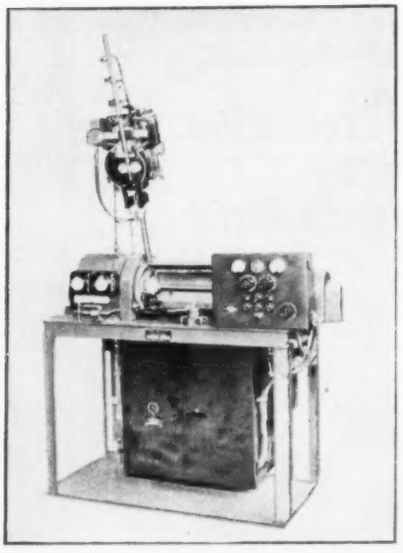
BALDWIN

Southwark

BLW THE BALDWIN GROUP

DIVISION OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

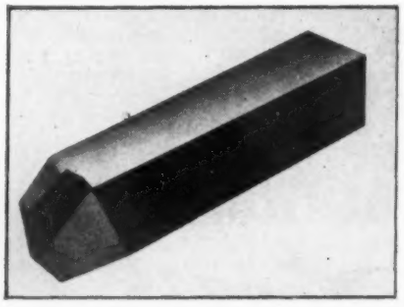
cludes a clamp for holding any standard stick electrode and for transmitting current to the electrode. The clamp is attached to the end of a feed rod upon which two feed rolls operate to maintain proper arc voltage through automatic thryratron control. The elec-



trode is accurately guided to maintain the arc in a predetermined location. Limit switches govern the extremes of movement in either direction. When more than one joint is to be welded with an electrode, an extra limit switch is used for each intermediate stop.

Carboloy Standardizes Shear Tools for Interrupted Cuts

Designed primarily to facilitate the machining of steel parts in which cuts are of the interrupted type, standardized designs of "shear type" tools have been established by the Carboloy Co., Inc., 11149 E. Eight Mile Road, Detroit, Mich. Shear type tools are characterized by a large negative back rake.



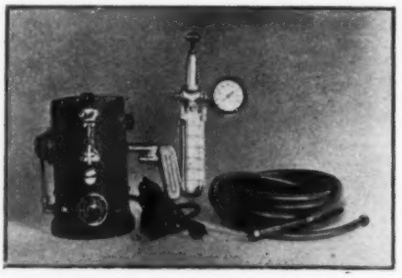
This negative rake results in a shaving form of cut when used for turning or facing. Thus when used for interrupted cuts, the impact of the tool does not come at the end of the tip.

The line includes four basic sizes of tools in both left and right end varieties, for a total of eight types. All tools have a negative back rake of 40 deg. All release angles are finish ground.

Alloy-Sprayer Atomizer Sprays Any Neutral Alloy

Alloy-Sprayer Co., 2040 Book Bldg., Detroit, Mich., has brought out a self-contained and portable metal atomizer which is capable of spraying any neutral alloy with a melting temperature of up to 600 deg. F. for protective coating, reproducing likeness and so forth. It is recommended for use in making templets, spotting or checking dies, reproducing molds, etc., and especially suited where accuracy of reproduction is very fine. It is claimed to be thoroughly foolproof in operation and requires only connecting-in with electric power and factory air pressure line for operation.

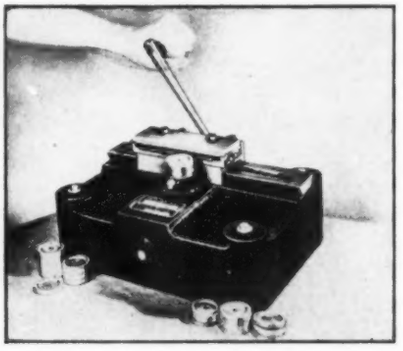
The model shown has 12 cu.in. capacity and is equipped with electrical elements for heating the metal. The temperature control is variable to suit individual alloys over a range of 100



deg. by means of a rheostat switch knob on the outside of the insulated pot. The metal is held at any pre-set temperature by a thermostat. The latch cover automatically seals the top of the pot to prevent air leakage during spraying. The spraying is accomplished by pressing the trigger on the handle of the gun, allowing the air to either draw, or force, the metal through the nozzle of the gun.

Acromark Marking Machine Carries Straight-Line Type

Aluminum aircraft instrument parts are marked in a machine developed by the Acromark Corporation, 9-13 Morrell Street, Elizabeth, N. J. Parts of other materials can be marked in the machine. A special mandrel holds the part as the slide carries straight-line type past it, impressing the mark.

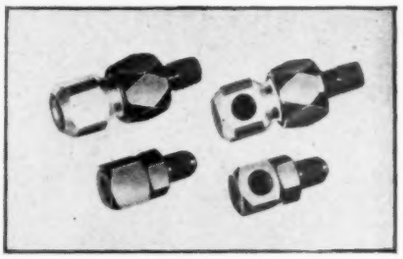


A shaft from the mandrel extends into the base of the machine and is rotated by a rack beneath the slide which controls the mark and insures accuracy. A geared arrangement advances the slide as the handle is moved forward and a second part is marked on the return stroke.

Trabon Straight and Angle Swivels Furnished In Two Types

A new line of straight and 90 deg. angle swivels for use in making grease, oil, air and other line connections between stationary, revolving, oscillating or other moving surfaces has been brought out by Trabon Engineering Corp., 1814 E. 40th St., Cleveland, Ohio. Two different constructions of swivels are available. Standard ball bearing swivels are supplied in ⅛, ¼, ⅜, ½, ¾ and 1 in. pipe sizes. Because of the ball bearing construction the swivels turn freely at any pressure without binding and are recommended if space permits.

Light duty swivels are built without balls and are intended for use only



in lighter work. They are offered in ⅛ and ¼ in. pipe sizes.

Both types of swivels are furnished with right hand threads in both head and stem, but they can be supplied on order with left hand threads in either the head or stem, or in both head and stem.

Murray Grid Unit Heater Has Cast Iron Construction

A grid unit heater made with cast iron heating sections instead of aluminum is being produced by D. J. Murray Mfg. Co., Wausau, Wis. It will withstand up to 250 lb. steam pressure. Because of the cast iron construction this unit is free from electrolysis that causes corrosion, leaks and breakdowns as only one type metal comes into contact with hot water or steam. The heater is available in eight sizes.

Lanco Die Head Will Handle Large Diameter Fine Threads

A special Lanco die head with an exceptionally wide range coverage has been introduced by the Landis Machine Co., Waynesboro, Pa. This Type RXX die head is equipped with chaser holders and chasers for threading 9¾ in. diameter fine pitch threads. It will

"Yes, our streets are paved with gold"

"You needn't worry, son, about what will happen here after we've won the war. I can see more happiness ahead than we have ever known.

"I came here from the Old Country half hoping to find gold in the streets. And true enough, I found it, but in a way I didn't expect.

"It's in the happiness we have because we are Americans. There's this pretty home, with its garden and shady trees. The automobile we all enjoyed. Your mother's electric refrigerator, washing machine and vacuum cleaner, that save her strength and give her more time to have fun with us. The radio, that no one keeps us from listening to whenever we feel like it.

"This is the gold I see in the streets of America. I see freedom, which is the finest of all gold. For freedom gives us what money cannot buy—the chance to get the happiness we want by working for it.

"Our enemies in Europe and Asia will never succeed in taking all this away from us. We are free and they are not. Free men always fight better. So we will win. Then you will learn for yourself, son, that our streets are paved with gold."

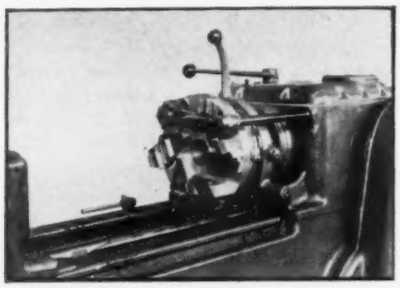
Revere Copper and Brass Incorporated was born at the time when America's system of free individual enterprise was first threatened from abroad. Paul Revere established this business to help our infant Navy prepare for the War of 1812 that lay ahead.

For 141 years, Revere has continued to serve the same principles of freedom by helping tens of thousands of American working men to find security and happiness, to serve themselves not only by producing, but by enjoying the fruits of their work.

Under this system, free men will win the war. Under it they can likewise win the peace. When that time comes, Revere expects to bring more thousands of our people the opportunity to rebuild their standard of living to levels still higher than before. For we believe that in this way alone can we keep faith with those who have fought.

REVERE COPPER AND BRASS INCORPORATED

★ *Founded by Paul Revere in 1801* ★



also handle diameters as large as 12 in. by employing chaser holders with a greater offset seating surface for the chasers.

All operating parts of the die heads are made of high carbon steel and are heat-treated. The chaser holders are made of steel forgings, and since the holders are supported by an enlarged closing ring they provide an unusually rigid support for the chasers.

Jansson Master Tri-Square Does Precision Measuring

A master tri-square suited to extreme precision measurement in laying out and checking right angle work and square surfaces, for checking of V's, straight flat edges and parallelism of cylindrical surfaces has been announced by the Jansson Gage Co., 19208 Glendale, Detroit, Mich. It is provided with

an inset hard fiber serrated grip to prevent heat transfer and slipping in handling. The vertical side edge is knife-sharp for truer visual gaging.

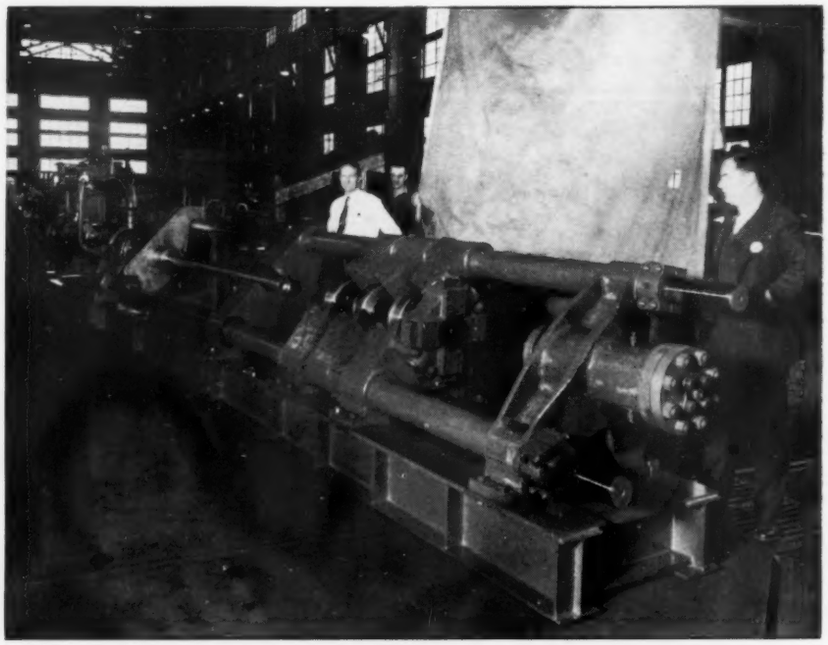
This gage is of one-piece solid construction. Held to limits of 0.00002 in. it is available in two sizes, 4 in. in height with a ⅝ in. wide standing base, and 6 in. in height with a 1 in. wide base.

It is hardened, ground and lapped from alloy tool steel. Final operations are performed in a special temperature control room.

Baldwin 76-Ton Draw Press Has 14-In. Piston Diameter

Announcement has been made by Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa., of a 76-ton horizontal hydraulic double-acting draw press with a piston diameter of 14 in., piston rod diameter of 9½ in. and a stroke of 87 in. This press has two horizontal columns on a 45-deg. angle, and is equipped with three adjustable die heads and one stripper head.

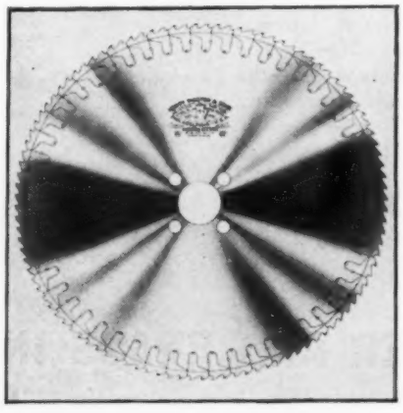
The extreme end of the machine is provided with a bumper cylinder while the drawing mandrel of the press is accurately guided in a bronze-lined guide casting.

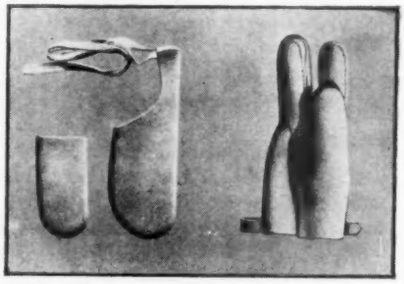


Henry Disston Metal-Cutting Saw Equipped With Inserted Sections

A circular metal-cutting saw with inserted section rather than inserted teeth has been introduced by Henry Disston & Sons, Inc., Tacony, Philadelphia, Pa. The saw can be readily sharpened on an automatic grinder. It can be operated at speeds up to 5,000 ft. per min. This design permits a thinner blade and cutting edge than is customary with saws having individual inserted teeth.

The design of the inserts is such that the cutting load is transmitted from each insert directly to the blade approximately at right angles to the resultant force, and not to adjacent inserts or to the rivets. Inserts are quickly and easily replaced should they be damaged by an accident.

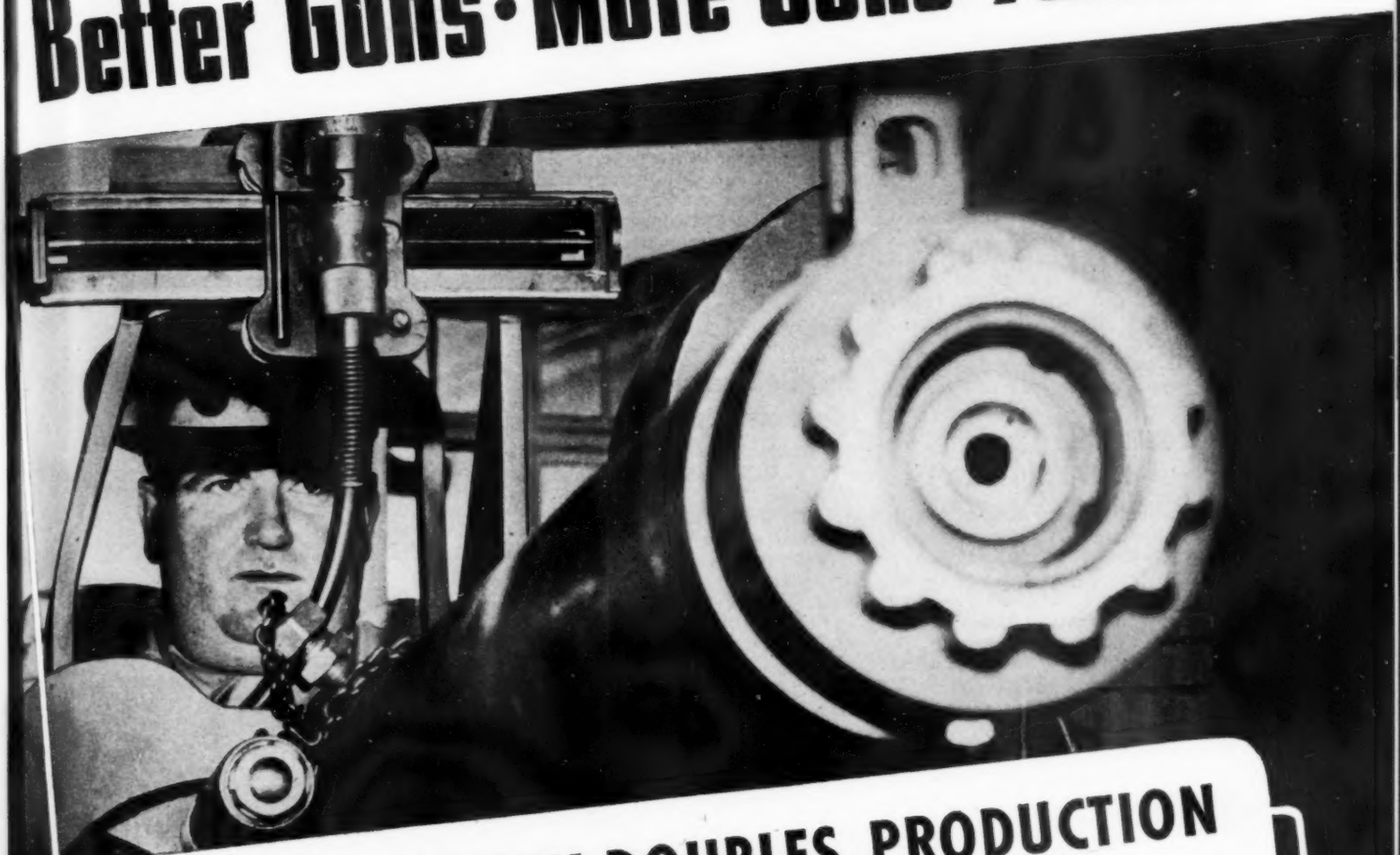




American Optical Co. Develops Chrome Leather Finger Guards

Three chrome leather finger cots have been announced by the American Optical Co., Southbridge, Mass. These are valuable where operators must handle small, rough objects or hot articles which are not too large in size. The AO 1000 cot is recommended for operations in which only one or two fingers need to be protected, or where there is only an intermittent finger hazard. No. 1001 is a tie-on type and is unusually large, so that it can be used to protect a finger or thumb that is band-

Better Guns · More Guns · *Faster!*



SUNICUT NEARLY DOUBLES PRODUCTION

Increases Tool Life 60%

Guns and more guns is the aim of America today — produce better guns . . . more guns . . . faster! That's exactly what one munitions manufacturer achieved when he called in a Sun Oil Engineer . . . one of those Doctors of Industry.

A change was made to Sunicut, the free-flowing, transparent sulphurized cutting oil, on machines producing parts for anti-aircraft guns. The improvement was noticeable almost immediately. Tool life increased 60% . . . finish was improved . . . and the output of vitally needed parts boosted from 2½ pieces per eight hour shift to almost 4½ . . . nearly doubling production.

That's another typical example of how Sunicut and Sun Oil Engineers are helping America step up production for victory!

Throughout the war industries . . . wherever metal cutting problems arise . . . Sun's *Doctors of Industry* and this extraordinary cutting oil stand ready, willing and able to help. Call on them to improve production in your plant. For helpful case histories of what they have accomplished in other leading metal working plants, write for your free copy of "Helping Industry Help America."

SUN OIL COMPANY • PHILADELPHIA

Sponsors of the Sunoco News Voice of the Air—Lowell Thomas

SUNOCO

SUN PETROLEUM PRODUCTS.. HELPING INDUSTRY HELP AMERICA

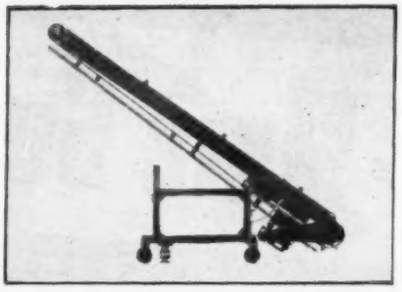
aged. The No. 1688 chrome leather twofinger and thumb protector is recommended for operations where several movements require finger protection while succeeding movements require the accuracy and sense of touch of a bare hand.

Carboloy Standardizes Both Solid And Tipped Type Boring Tools

Carbide boring tools have been standardized by the Carboloy Co., Inc., 11149 E. Eight Mile Road, Detroit, Mich. The standard boring tools are being made available in sizes ranging from 3/32 to ¼ in. diameters in the solid Carboloy form, and in diameters ranging from 5/16 to ½ in. for the tipped types. Both solid and tipped types will be furnished cylindrically ground with tolerance of plus 0.000 to minus 0.001 in. with cutting edges unground. This will permit the user to grind cutting edges to suit specific jobs.

Lamson Utility Conveyor Is Adjustable Belt Type

An adjustable belt type utility conveyor has been brought out by the Lamson Corp., Syracuse, N. Y. It is easily moveable and adjustable because of proper balancing and convenient hand rail. Locks on two wheels and a lock on the adjustable incline boom assure rigid operating position. The conveyor is instantly reversible and loads wider than the belt are possible because of the absence of side guards. A self-locking drive prevents the load from



running back when the motor is stopped. The motor fits any standard light circuit.

This Model CM conveyor is portable and operates from horizontal position to a maximum of 35 deg. It is 11 ft. long, belt 14 in. wide and approximate speed is 60 ft. per min. The maximum capacity is 100 lb. or 600 lb. per min.

Wiremold Develops Receptacles For Installation in Their Plugmold

The Wiremold Co., Hartford, Conn., has developed two new receptacles for installation in their "Plugmold". No. 2127P is a 3-wire polarized receptacle especially adapted for those installations where solid ground is required for small tool motors. No. 2127S is a universal type receptacle designed to take plugs with either parallel or tandem blades. The use of these new receptacles increases the general utility for industrial installation to provide electrical service at points where the use of portable electrical appliances and tools is necessary.

G. E. Produces Sodium Lamp For Fine Flaw Detection

A sodium lamp for microscopic flaw detection has been announced by General Electric Co., Schenectady, N. Y. It is essentially an arc lamp and differs from the incandescent light in that it requires a special socket and individual control for each lamp.

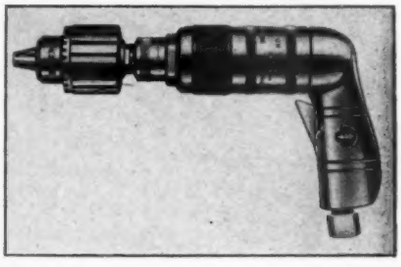
Sodium light is golden yellow and a given amount of energy from it produces several times as much illumination as the same amount of energy in white light. For microscopic inspection monochromatic light is most effective when spread uniformly over a large area rather than concentrated in small bright patches.

In searching for cracks and blow

holes it has been found helpful to treat the part with either a light-absorbing or light-reflecting dye. This increases the contrast between the flaw and the object to the point where many times smaller flaws can be detected.

Aro Equipment Corp. Air Drills Are Straight or Right Angle Type

The addition of ⅜ in. capacity air drills, straight and right angle, to their line of rotary pneumatic tools is an-

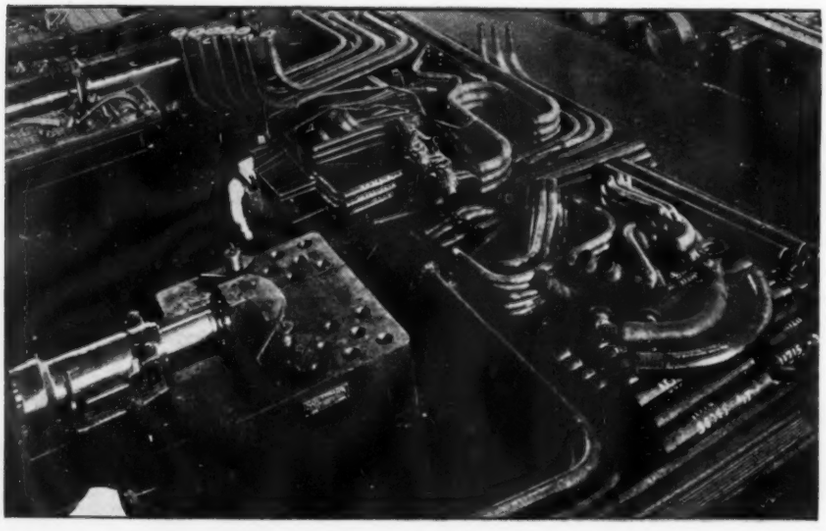


nounced by The Aro Equipment Corp., Bryan, Ohio. These drills should be suitable for a wide range of jobs for defense plants, aircraft builders, shipyards, and other industrial plants.

Baldwin Hydraulic Press Bends Pipe Without Heating

A 200-ton hydraulic pipe bending press which has power sufficient to bend pipe when cold has been introduced by Baldwin Southwark Div., Baldwin Locomotive Works, Philadelphia, Pa. This feature eliminates distortion in the pipe resulting from cooling in addition to saving the time which is required to heat pipe.

This machine is self-contained and oil operated and under complete control of the operator at all times which is of particular value when difficult bends are made.



Monsanto Plastic Window Pane Withstands Bomb Explosion

A window pane of transparent plastic laminated with wire mesh has been announced by the Monsanto Chemical Co., Plastics Div., Springfield, Mass. It has been developed to withstand the explosion of a 150-lb. bomb eight feet

"STANDARD EQUIPMENT" IN PEACE IS ONE THING

BUT TODAY, almost before a test pilot can take a new fighter plane "upstairs," its design is changed. Faster engines are constantly being demanded — and delivered . . . tougher fabricating materials developed.

Yet the warplane whose wings are still blueprint paper has one thing in common with aircraft designs that have gone before — the Torrington Needle Bearing.

Changed-over to production-for-war, the Needle Bearing is once more proving its adaptability, in applications where its unique advantages mean more than ever. Low coefficient of friction, for example, makes it especially well-suited to manual control operations in fighter planes, assuring smooth, steady performance.

Not only in aircraft production but throughout industry, every feature of the Needle Bearing is filling some vital wartime need. Its small size is saving space and critical materials . . . its remarkable ease of installation cutting assembly time, its design eliminating extra parts and assembly steps, its high capacity and efficient lubrication reducing the need for replacement or maintenance attention in service.

Small wonder that the Torrington Needle Bearing has become standard equipment, too, in America's production-for-Victory program.

***FOR INFORMATION** concerning capacities and sizes, send for Catalog No. 105. Or consult a Torrington engineer. He is well qualified in adapting the Needle Bearing's unique advantages to specific problems.*

THE TORRINGTON COMPANY
TORRINGTON, CONN., U. S. A. • *Est. 1866*
Makers of Needle and Ball Bearings
New York · Boston · Philadelphia · Detroit
Cleveland · Seattle · Chicago · Los Angeles
San Francisco · Toronto · London, England

TORRINGTON NEEDLE BEARING

Every feature fills a wartime need

away. The material consists of standard 16-mesh wire screening sandwiched between two sheets of Vuelite, a transparent cellulose acetate sheeting. Sheets of the laminated plastic can be drawn or formed to almost any desired shape.

The panes are available in eight standard size panels from 9½ in. square to 19½×24½ in. The standard panels are drawn with a quarter-inch flange which can be easily and quickly fastened to wood sash with an automatic stapler and then puttied to form a permanent, weather-tight installation.

NEW MATERIALS

Kutkost Cutting Alloy Made In Three Hardness Grades

Introduction of a cutting material known as Kutkost has been made by the General Tool & Die Corp., 555 Prospect St., East Orange, N. J. This alloy contains a high percentage of tungsten and cobalt and 1 percent boron, along with other metals, and is extremely dense and tough.

It is furnished in three grades, V, X, and XV. Grade V is intended for use on heavy roughing cuts with feeds of 1/32 to ⅛ in., the Rockwell "C" hardness being 61-63. The general purpose grade is designated as X and has a Rockwell "C" hardness of 65-67. The feed recommended on ferrous metals is from 0.010 to 1/32 in. The grade XV Kutkost has Rockwell "C" hardness of 68-70 and is used for finish cuts on ferrous metals and for general duty on non-ferrous materials.

Gray-Mills Metal-Cutting Coolants Are Manufactured in Four Types

A new line of metal-cutting coolants has been developed by the Gray-Mills Co., 213 W. Ontario St., Chicago, Ill. They are offered in a wide range of container sizes: 3, 5, 15, 30, 50 and 55 gal. Known as "Flo-Bac" coolants, they are manufactured in four types.

Vard Lathe Compound Rest Permits Close Thread Cuts

Threads may be cut right up to a working shoulder at normal lathe speeds by use of the new Vard lathe compound rest introduced by Vard Inc., Pasadena, Calif. This supplementary attachment, replacing the cross-slide of the lathe, holds a single or multiple toolpost and is equipped with a graduated dial accurate to 0.001 in. A quick release lever withdraws the tool point 3/16 in. by one transverse motion of the hand. By simultaneously reversing the lathe and releasing the rest the next cut can be set on the compound dial with one hand as the lathe compound reverses the tool to the starting point of the cut.

Elektro-Purj-It Cleaner Removes Dried Oil Stains

An all-around deodorizing cleaner known as Elektro-Purj-It has been introduced by the Trojan Products & Mfg. Co., 3130-36 S. Wabash Ave., Chicago, Ill. This chemical removes dried oil stains and discolorations and restores natural color of paint on machinery. Rust, grease and weather corrosion can be dissolved on glass instantly by the use of this cleaner. It is said to make greasy, oily cement and wood floors look like new and disinfects as it cleans. It is harmless to porcelain and enamel surfaces and restores natural brightness to linoleums, mastic, cement and terazzo surfaces.

Murphy Mur-Cela Liquid Cleans Many Metal Articles

Mur-Cela, a liquid resembling table syrup used for cleaning metal articles, has been introduced by the Murphy Chemical Corp., 480 Lexington Ave., New York, N. Y. It is neutral, non-injurious to ferrous or non-ferrous metals and non-toxic. When metal parts to be cleaned are dipped in hot Mur-Cela and kerosene mixture, they are cleaned in a few seconds. This fluid eliminates scrubbing and hand wiping. It will convert mineral oils and greases into a true emulsion just as an alkali solution emulsifies olive or lard oil.

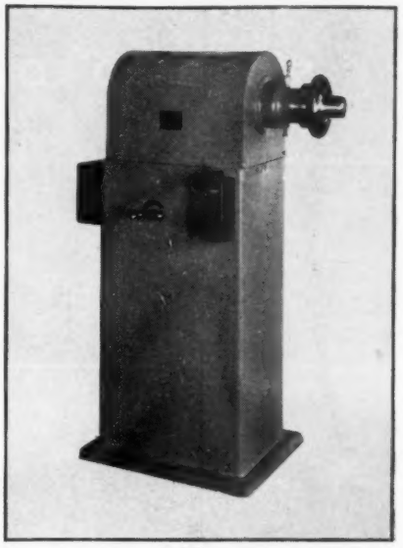
Curran Corporation Oil Well Dehydrates Steel Surfaces

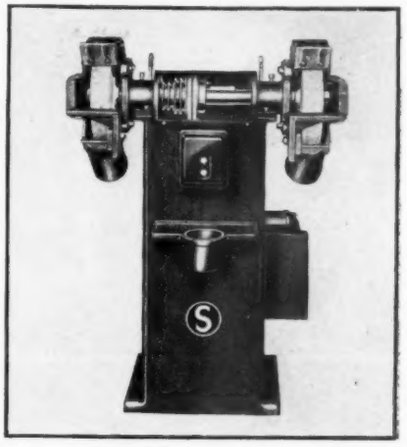
An oil which is said to be superior to alcohol for dehydrating and cleaning steel surfaces, bearings or similar parts which have become wet or have been left with a film of grinding emulsion, has been announced by the Curran Corporation, Malden, Mass. Known as "Polar K" oil, it displaces and absorbs water and leaves a thin film of lubricant and rust preventative. It is completely soluble in hydrocarbon and lubricating oils and no subsequent cleaning procedure is necessary to remove the thin, film-protective coating.

Trojan Quik-Sil Compound Prevents Floor Slipping

Announcement has been made by the Trojan Products & Mfg. Co., 3130-36 S. Wabash Ave., Chicago, Ill., of Quik-Sil oil absorbent compound which cleans greasy floors and prevents slipping when applied to the floors. This material requires no mixing and dries up heavy, wet oil accumulations quickly. It is claimed to be harmless to shoes, odorless, dustless and will not burn when oil soaked. Kerosene, gasoline and various solvents can be dried up by application of the compound.

Correction





The illustrations showing a multi-speed grinder made by the Standard Electrical Tool Co. and a variable speed lathe made by the Schauer Machine Co. (*AM*—Vol. 86, pages 917, 918) were inadvertantly placed with the text describing the other machine. The two illustrations are reproduced above, the Schauer variable speed lathe at the top and the Standard multi-speed grinder at the bottom.

M & L Precision Tapper Produced by Leckinger

The M & L No. 1 Precision Tapper (*AM*—Vol. 86, page 854) is manufactured by Leckinger Machine Co., Los Angeles, Calif. The Brand Tool & Supply Co. mentioned in connection with the machine is the distributor. The tapping machine is supplied in both bench and floor models which give identical performance for precision tapping 0 to ½ in. on chrome moly steels, and up to ¾ in. on softer metals such as aluminum, brass and plastics. The floor model is equipped with a coolant system and centrifugal pressure pump.

HOW "Detroit" STANDARDIZED SPECIAL TAPS for SHELL for FASTER DELIVERY

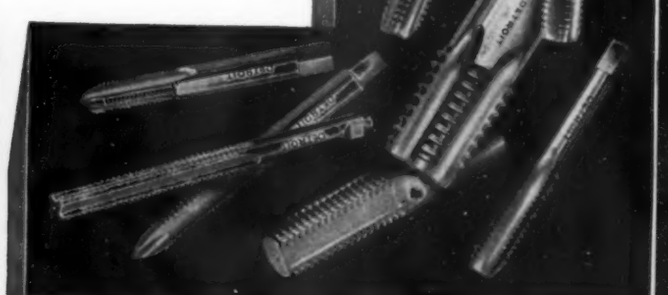
Above: A group of 40 mm. shell, with some of the standardized DETROIT taps and the DETROIT thread gage used for checking the threads.★

A year ago practically every manufacturer of 40 mm. shell had his own specifications for the special taps required for identical operations: threading the ends of the shell body. With a score of companies involved, Detroit Tap engineers saw that if an agreement could be reached on the design of tap for these identical operations by different manufacturers that deliveries of taps could be speeded.

After thoroughly investigating the field requirements, Detroit Tap engineers recommended two standardized designs, one for each end. ★Today already well over half of these 40 mm. shell producers are using standardized special "DETROIT" taps—now turned out by "DETROIT" on a PRODUCTION basis with greatly expedited deliveries.

★Similar Standardized Taps for 20 mm. Shell also available

A new Detroit Tap Catalog will be off the press shortly. Shall we reserve a copy for you? Ask for Catalog 22AM on your company letterhead.



DETROIT TAP & TOOL Company 8432 BUTLER DETROIT

THE ENDLESS PRODUCTION TOOL WITH 1680 TEETH ON A 10 FT. BAND

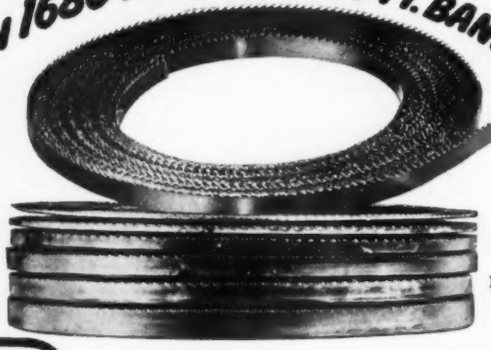


Illustration of 100-ft. coils

DoAll BAND SAWS

The *continuous* cutting ability of DoAll Contour Saws is a real production feature. 25,000 separate teeth contact the work *every minute* when a 10-foot DoAll band travels at the rate of 150 f.p.m. The constant chip producing capacity makes this the fastest machining method of slicing off metal ever devised.

IF YOU HAVE A TOUGH MACHINING JOB—

One that has you stumped—send it to our Research Laboratory, the only place of its kind, for free analysis. Our experts will make tests and submit a detailed report showing you how to do the work in the quickest, easiest manner.

EASY TO HANDLE

Each 100-ft. coil comes in a strong metal box, through the slot of which any desired saw length can be drawn and cut off.

FREE— 32-page book on DoAll Band Saw Performance.

Pat. No. 2,255,577 Des. No. 127,313 Other Pats. Pending

THE DOALL COMPANY

1210 Thacker St., Des Plaines, Ill.

Associated with Continental Machines, Inc., Minneapolis, Minn.

TRADE PUBLICATIONS

BORING MACHINES The B. M. Root Co., York, Pa., offers Catalog No. 120, illustrating and describing boring machines and multiple-spindle drill heads for boring light metals and plastic composition materials.

BRAZING An article entitled "Silver Alloy Brazing of Fabricated Copper Piping," by J. C. Powers, Jr. and H. DeM. Lucas is offered by Handy & Harman, 82 Fulton St., New York, N. Y.

COMPRESSORS Schramm, Inc., West Chester, Pa., offer catalog 4215 containing illustrations and descriptions of Fordair compressors.

CONTROLS In a 15-page bulletin, Z6000, Wheelco Instruments Co., Harrison and Peoria Sts., Chicago, Ill., illustrates and describes measuring and controlling instruments offered in steel and cast iron cases.

CUTTING TOOLS A list of hobs, milling cutters and reamers on hand in their stockroom is available from the Barber-Colman Co., Rockford, Ill.

CYLINDERS The 51-page bulletin, No. 57, published by Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., contains illustrations, drawings and descriptions of pneumatic cylinders.

DIES A 12-page manual, Bulletin D-113, covering standardized dies for small arms ammunition and containing an operator training section on the finishing and servicing of carbide dies, is offered by Carboloy Co., Inc., Detroit, Mich.

DIESEL TRACTORS To obtain "Caterpillar Diesels Go to War," a 14-page booklet released by Caterpillar Tractor Co., Peoria, Ill., request Form 7610.

GEAR LEAD CHECKER A bulletin describing the 1205 "Sine-Line" gear lead checker, suitable for use with their gear checking recorder, is available from the Michigan Tool Co., 7171 East McNichols Rd., Detroit, Mich.

GRINDER Features of the No. 12 vertical rotary surface grinder are listed in the folder of the Portman Machine Tool Co., 17 and 19 Beechwood Ave., Mount Vernon, N. Y.

HOB SHARPENING "The Right and Wrong of Hob Sharpening" is the title of a technical data bulletin issued by the Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.

INSTRUMENTS Direct current and alternating current indicating instruments for mounting on switchboards are described in 12-page catalog 4220 published by the Roller-Smith Co., Bethlehem, Pa.

LIFTERS Descriptive data on barrel and drum lifters, electric hydraulic lifters, Lever Lift hydraulic lift trucks and portable cranes are available from Service Caster & Truck Co. of New England, 440 Somerville Ave., Somerville, Mass.

LIGHTING The Wiremold Co., Hartford, Conn., announces publication of catalog FL-5 and price list FL5-C1 covering "V"-type cover fluorescent lighting units and Line-O-Lamps adaptable to a wide range of lighting applications.

MOTOR DRIVES A simplified technique of mounting individual motorizing units with standardized brackets on any type of machine tool is described in the illustrated catalog issued by Drive-All Mfg. Co., 3400 Conner Ave., Detroit, Mich.

MOTORS .A folder concerning a totally inclosed, fan cooled electric motor is available on request from the Torq Electric Mfg. Co., 6603 Carnegie Ave., Cleveland, Ohio.

PORCELAIN ENAMEL Issued by The American Rolling Mill Co., Middletown, Ohio, "Porcelain Enamel—A Non-Critical Finish for War Time Uses" is a 23-page booklet which interprets porcelain enamel as a finish for various war products and industrial applications and contains a chart showing where the "lifetime" finish can be used to replace critical materials.

SCREW THREAD SYSTEM Catalog No. 5, issued by the Aircraft Screw Products Co., Inc., 47-23 35 St., Long Island City, N. Y., contains eleven pages of information on the "Aero-Thread" screw thread system for the reinforcement of tapped threads in light metals.

THERMOMETERS The Bristol Co., Waterbury, Conn., has published bulletin T302, giving detailed information concerning construction, forms in which furnished and applications of fully-compensated liquid-filled recording thermometers.

TRANSFORMERS A copy of 46-100, a 24-page booklet on completely self-protecting CSP distribution transformers with Hipersil core, may be secured from Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

VALVES A line of portable electric magnetic valves which resist vibration and change of motion as well as operate in any position is described in Bulletin S-304 issued by General Controls Co., 801 Allen Ave., Glendale, Calif.

VERTICAL PUMPS Bulletin 260-A, issued by Watson-Stillman Co., Roselle, N. J., is an 8-page illustrated bulletin presenting their line of vertical pumps including simplex, duplex and triplex types in a wide range of models and capacities.

Men are Dying . . .
Furnaces are Cold
—But you don't care!

IT IS difficult to believe that there are men who don't care—perhaps it's a case of not fully realizing the situation, but here are the facts.

Our boys are fighting, dying at the front. They need steel to protect them, weapons of steel to fight with, and yet some furnaces are cold that should be making steel night and day. With thousands of tons of scrap lying around the country, there is not enough gathered in to keep all the furnaces going, to say nothing of building up a back-log for the winter months.

Steel is usually made of 50% pig iron and 50% scrap. The blast furnaces are operating 24 hours a day making all the pig iron possible, so the only chance of increasing our steel output is to get more steel scrap.

Your production scrap is, of course, collected in the routine way, but it is the broken and obsolete equipment, the old jigs, tools, dies, parts, etc. that are not moving, and they can not move without your authority.

So make a thorough recheck of your plant, storage rooms and equipment yards. Give orders to scrap everything that is not needed for current operations. The need is so critical that we cannot urge you too strongly to act at once.

RYERSON STEEL-SERVICE

National Emergency Alternate Steels

Designation	Chemical Composition (b)				
	C	Mn	Mo	Ni	Cr
NE8024	0.22-0.28	1.00-1.30	0.10-0.20	....	....
NE8124	0.22-0.28	1.30-1.60	0.25-0.35	....	....
NE8233	0.30-0.36	1.30-1.60	0.10-0.20	....	....
NE8245	0.42-0.49	1.30-1.60	0.10-0.20	....	....
NE8339	0.35-0.42	1.30-1.60	0.20-0.30	....	....
NE8442	0.38-0.45	1.30-1.60	0.30-0.40	....	....
NE8447	0.43-0.50	1.30-1.60	0.30-0.40	....	....
NE8547	0.43-0.50	0.70-0.95	0.40-0.60	0.40-0.60	0.40-0.60
NE8			0.15-0.25	0.40-0.60	0.40-0.60
NE8					0.40-0.60
NE					
NE					
NE					
NF					
NI					

Will the Machinability of NE Steels prove to be a Tough Problem?

THE answer will be "Yes" or "No"—depending upon the skill used in handling the change-over.

Changes may be required in tools and tooling; changes in speeds and feeds, *and in cutting fluids.* When this last factor is considered

Stuart Oil Engineering Service

is equipped and ready to help you apply the *Right Cutting Fluid* to "cranky" steels.

Stuart's Thred Kut
HEAVY DUTY CUTTING OIL
Recommended by America's leading machine tool builders

Stuart's SOLVOL
LIQUID GRINDING COMPOUND
For carbide tools and where an "aquamix" solution is recommended

Stuart's CODOL
LIQUID GRINDING COMPOUND
Meets every test for the ideal Modern Grinding Compound

Stuart's "SUPER-KOOL"
AMERICA'S FIRST TRANSPARENT SULPHURIZED CUTTING AND DRAWING OIL

For All Cutting Fluid Problems
D. A. STUART OIL CO.
Chicago, U.S.A. • LIMITED • Est. 1865
Warehouses in All Principal Metal Working Centers

NEW BOOKS

PLANT PROTECTION—*By E. A. Schurman, chief of protection, the Glenn L. Martin Company.* 148 *pages. Published by the Cornell Maritime Press,* 350 *West* 23 *St., New York, N. Y.* $2.

Industrial plants and their products must be protected against work stoppages caused by sabotage; entry into these plants must be limited to employees and other authorized persons.

Plant protection is now a specialized branch of modern police science. Industrial police departments must adopt new methods in order to keep pace with requirements for additional security. Essentially, the work of industrial plant protection forces lies in the prevention of crime, rather than the investigation of crimes already committed.

This book tells how to set up and arm a modern protection department and how to reorganize a present set-up; it incorporates instructions to men on the protection force on how to do their job efficiently.

In preparing this handbook, the author has not attempted to treat all subjects in detail. It has been assumed that those who will make use of it will have the necessary knowledge to qualify them for their work and will, therefore, be in a position to enlarge upon the ideas and principles advanced. It is not expected that all of the recommendations, procedure and forms can be applied indiscriminately to all organizations.

The author spent four and a half years as an agent of the United States Secret Service. During this time he served as superintendent of the uniformed force of the United States Secret Service. This organization has the responsibility for the protection of the Bureau of Engraving and Printing and other Treasury Department buildings in the District of Columbia. In April, 1941, he reorganized and became chief of the protection department of the Glenn L. Martin Company.

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WELDING—*By James A. Moyer, state director of university extension in Massachusetts.* 185 *pages. Published by the McGraw-Hill Book Company,* 330 *West* 42 *St., New York, N. Y.* $2.25.

Various modern methods of welding metals, particularly iron and steel, are described in this book. It should be particularly useful to students in vocational and engineering schools who must have a broad picture of welding and the equipment employed. The text is divided into 17 chapters, each of which discusses the characteristics of certain types of welding equipment or some welding process. Drawings, photographs and tabulated data are employed throughout the book to increase its value to students.

THE CARE AND OPERATION OF A LATHE—*106 pages. Published by the Sheldon Machine Company, 1624 North Kilbourn Ave., Chicago, Ill. 50 cents.*

This pocket-size manual, written for the apprentice and the student machinist, illustrates and explains the modern back-geared screw cutting lathe and describes basic lathe operations. The text is well illustrated with drawings and photographs which show standard lathe parts, typical turning and boring tools, and common job setups. While not a "shop kink" book, nor a handbook of tables, this manual incorporates a number of practical suggestions on lathe operations that will be helpful both to the apprentice and the journeyman machinist. While the descriptions of lathe parts and accessories apply principally to Sheldon lathes, they are sufficiently general to be applicable to practically all makes of standard engine lathes.

•

HOW TO CONDUCT CONFERENCES—*By Alfred M. Cooper. 191 pages. Published by the McGraw-Hill Book Company, 330 West 42 St., New York, N. Y. $1.75.*

Success of any conference depends on properly conducting it. The leader must know how to direct group discussion to a useful conclusion. Characteristics which make a good conference leader and points to guide him in starting the conference are brought out in the first chapter. Other topics discussed are the planning of the meeting, developing discussion questions, a list of 20 motives to which an appeal may be made in any conference together with a brief analysis of each.

Remaining chapters are devoted to the business conference, selling and teaching by this method, further applications in the educational field, and concluding with finer points of conference leadership.

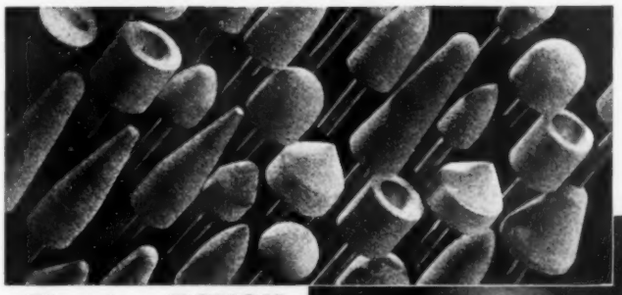
•

WELDING STANDARDS—*Prepared by Technical Committees of the American Welding Society, and published by the American Welding Society, 33 W. 39 St., New York, N. Y. 40 cents each.*

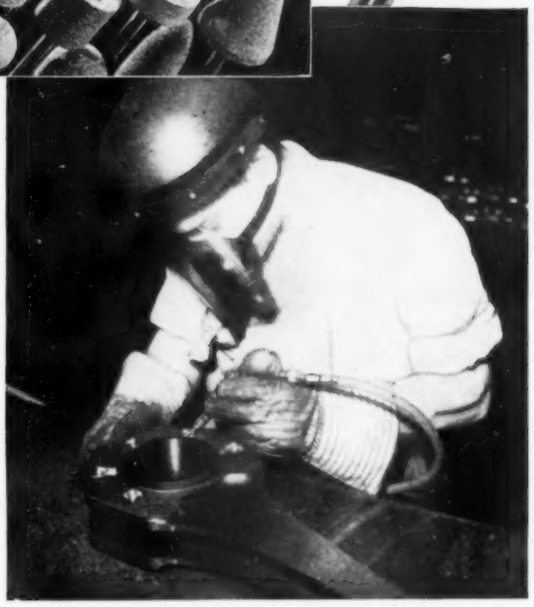
The American Welding Society has published two revised welding standards, entitled "Standard Methods for Mechanical Testing of Welds," and "Definitions of Welding Terms and Master Chart of Welding Processes." Both of these standards were prepared by technical committees of the Society, and are revisions of earlier bulletins of the same title.

The 25-page bulletin entitled "Standard Methods for Mechanical Testing of Welds," describes in detail the principal mechanical tests applied to welds, including tests for density, soundness, tensile strength, shearing strength and ductility. The booklet describes the methods of making the tests and evaluating results, and includes sketches

POLISH 'EM OFF WITH



They're TOUGH and DO their STUFF!



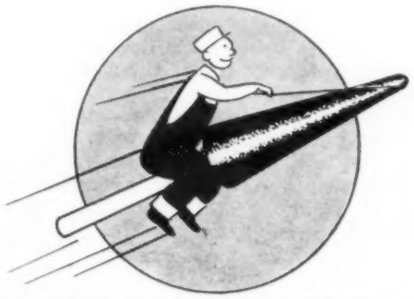
Commandos of the grinding wheel industry—the first small wheels mounted on steel shanks and leading the way today with smoother, more rapid grinding, polishing and finishing of difficult jobs.

Chicago Mounted Wheels—the result of 45 years of KNOW HOW—come in a wide range of styles on different size shanks, for use with any portable or flexible shaft grinder. Several special-formula abrasives give 150% to 300% longer service. More than 200 shapes, all mounted and rarin' to go.

HI-POWER GRINDER

Here's a real production tool—a 3-pounder with enough power to drive a 2½" diameter wheel. 17,000 r.p.m. In case with accessories, $38.50.

LATEST CATALOG—Packed full of comprehensive information and pictures. You'll be interested. Send for copy.



TEST WHEEL FREE

If you have a grinding problem, send for a Survey blank, which you'll find easy to fill out. Upon its return, our abrasive engineers will analyze it and send you without charge the trial wheel they recommend for your particular job.

CHICAGO WHEEL & MFG. CO.

Makers of Quality Products Since 1896

1101 W. Monroe St., Dept. AT, Chicago, Ill.

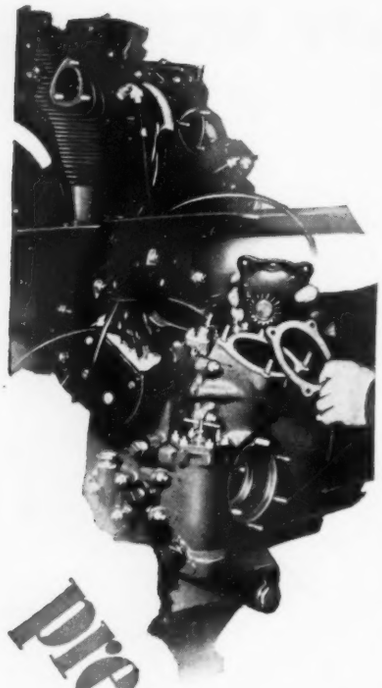
AT-9

☐ Send Hi-Power Catalog
☐ Free Wheel

Size .....

Name .....

Address .....



precision . . . quick

In close-precision aircraft adjustments . . . *quick* accuracy is insured by Laminum shims. From factory assembly to vital field servicing! Laminum shims (easily peeled precision brass laminations) are cut to your specifications.

Stock shim materials obtainable from mill supply dealers. (Write us for shim application folder and Laminum sample.)

Laminated Shim Company, Inc.
Union St., Glenbrook, Conn.

it's
LAMINUM
THE SOLID SHIM THAT peels FOR ADJUSTMENT
1813

of the standard specimens. Some of the tests apply to the weld metal alone; others apply to butt-welded joints and fillet-welded joints. In addition, there is a section on etching reagents and procedures for etching.

The standard definitions of welding terms adopted by the American Welding Society are given in the 32-page bulletin, entitled "Definitions of Welding Terms." The terms are grouped under appropriate headings and subheadings, so that closely related terms appear together and their relationships may be more readily understood. In addition, this booklet includes an index in which all terms are listed.

SEEN and HEARD

Slogan With a Punch

Many slogans found in war-industry plants remind workers that the men on our fighting fronts need more and more ordnance equipment and materiel of war. One of the best we have run across recently reads: "No brave man shall die because I have failed to do my job."

Stopped Cold

Even though his responsibilities have been multiplied many times and he is working longer hours than ever before, it still takes a lot to "stop" the average machine shop foreman. Nevertheless, a friend of ours in a Detroit war plant didn't have a word to say the other day when a new man, recently assigned to operate a brand new milling machine, called him over, pointed to six broken cutters and asked "What do I do next?"

Amazons Go to Work

Tall women are being sought for employment as operators of some of the larger machine tools in Wright Aeronautical Corporation plants. Job studies have shown that operators of large crankcase drills, for instance, must be 5 ft. 8 in. tall or over in order to operate these machines efficiently without tiring. The height requirement is largely for the sake of "reach," as the proportionately longer arms of taller persons enable them to reach into the drills while they are at rest and properly fasten the parts in the fixtures.

The company's search for women machine tool operators over 5 ft. 8 in. tall is a new development in putting women to work on war production jobs. Heretofore, height has not been a factor in the selection of women for work as machine tool operators in metalworking shops. In fact, at some of the other machine tools where "reach" is not so important, Wright Aeronautical supervisors have provided platforms so small girls could reach operating levers and make necessary adjustments.

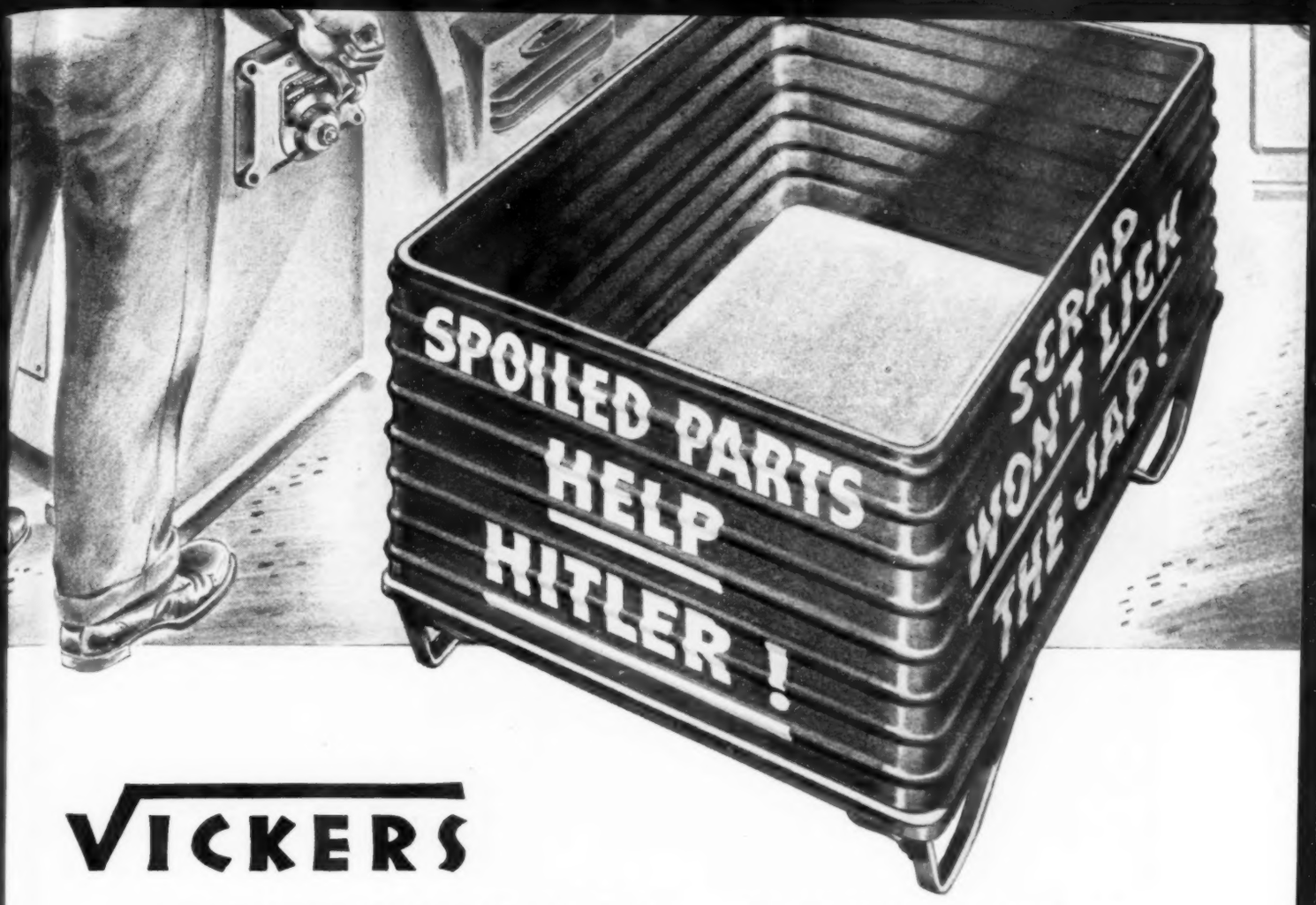
On Guard

in plants all over the country — are Pioneer Pumps — furnishing proper flow of coolants to the whirling wheels of machinery — to make sure that fighting equipment for Uncle Sam is being produced under most efficient conditions.

Over 375 different pump models are represented — each one selected for its particular place because its design best fits the job at hand.

Pioneer Pumps are dependable.

PIONEER PUMP
AND MANUFACTURING CO.
19651 John St. Detroit, Mich.



VICKERS

HYDROMOTIVE CONTROLS REDUCE WORK SPOILAGE

In the first place, Vickers Hydromotive Controls are always on the job. They give the work an unflagging attention impossible to the best human operator . . . distractions don't mean mistakes.

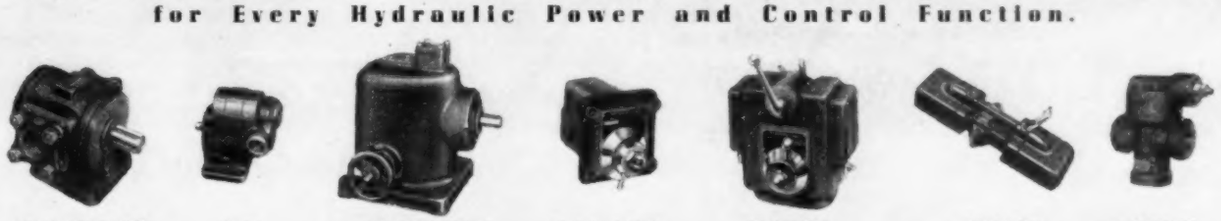
Then, Vickers Hydromotive Controls are extremely versatile. They can be set and interlocked to produce any desired sequence of operations and they will keep right on producing this sequence until changed. The interlocks can be arranged so that wrong operations are impossible.

Finally, these controls lend themselves easily to finest adjustments, yet they are extremely sturdy and dependable.

All of these factors help eliminate spoilage . . . with a consequent saving of precious time and critical metals. Vickers Application Engineers are always available to discuss individual problems of improving machine controls.

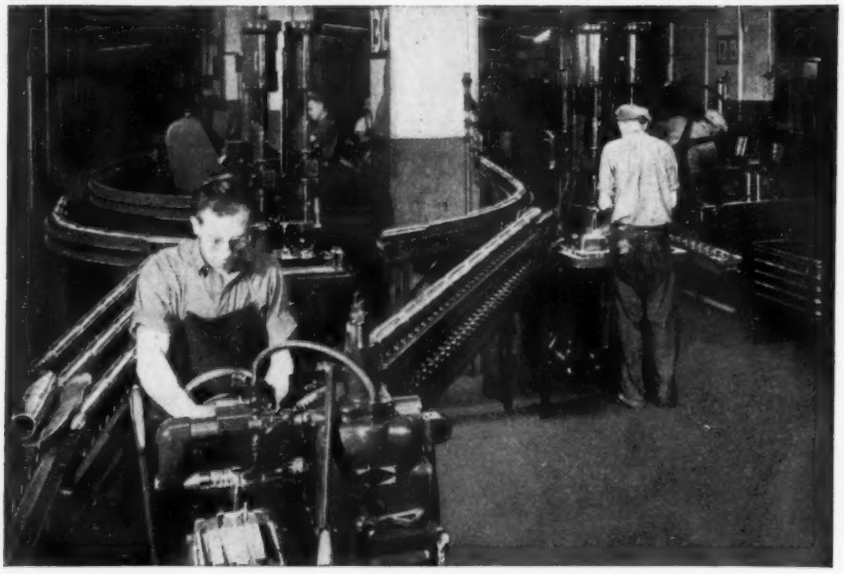
VICKERS *Incorporated* • 1454 OAKMAN BLVD. • DETROIT, MICHIGAN

Representative of More than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function.



CONSTANT DELIVERY PUMPS | FLUID MOTORS | VARIABLE DELIVERY PUMPS | FLOW CONTROL VALVES | TRAVERSE & FEED PANELS | SOLENOID OPERATED VALVES | PRESSURE CONTROLS

MOVE MATERIAL ★ SWIFTLY— SMOOTHLY—



With "Mechanized" Handling on Standard Conveyors

MAINTAIN your "Victory" production pace . . . install Standard Conveyors to assure a smooth, uninterrupted flow of materials and parts through "mechanized handling" all along the production line—to avoid congestion in working areas—to release men for production work—to make better use of existing plant space.

Write for Bulletin AM-9, "Conveyors by Standard"—shows all types of Standard power and gravity conveyors that will aid you to maintain and increase the schedule of production in your plant.

STANDARD CONVEYOR COMPANY
GENERAL OFFICES: NORTH ST. PAUL, MINN.
Sales and Service in All Principal Cities

Shop Bulletin Increases Manufacturing Efficiency

By J. MANUELE

Director of Quality Control
Westinghouse Electric & Manufacturing Company

Today, most large shops have a suggestion system for rewarding employees who show initiative in devising better methods of doing things. Many clever ideas are worked out by manufacturing engineers as part of their every-day duties, which do not form a part of the suggestion system. Some of the ideas can be adopted by other departments or by other plants of the same company. The problem is how to give proper publicity to these suggestions.

Our company solved this problem several years ago. We are constantly receiving from various manufacturing supervisors descriptions of new methods of doing some particular operation which has been worked out in their department. Only ideas which have been actually put in practice and found to be an improvement over previous methods are accepted. In submitting a description of the processes or operation, suitable photographs or sketches of the equipment are sent in, together with a detailed description of how the operation is performed or how the equipment functions.

These ideas are collected in a pool which serves as a constant reservoir. Each month eight items drawn from this pool are published in a four-page leaflet entitled *Shop Ideas*. This leaflet is mailed to about 450 manufacturing supervisors, whose duties are directly connected with shop operations.

Any idea which might be applied in any particular department is reviewed by the person responsible for manufacturing operations in that particular department. It often happens that the idea is not directly applicable to a department other than that in which it was developed. However, the principle can often be modified and adapted to local conditions.

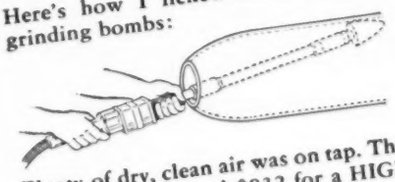
In order to encourage manufacturing supervisors to improve their methods and to send in descriptions of improvements they have adopted, a by-line given in the bulletin gives credit to the plant submitting the idea. Naturally, most suggestions come from the more progressive plants, but the other plants are not slow to follow, especially when encouraged by the publicity received in the bulletin.

Manufacturing supervisors like to see the name of their plant in print, especially when it is brought to the attention of other plant supervisors in similar positions. This creates a healthy spirit of rivalry. When ideas are published in trade journals, credit is given the individual responsible.

Shop Ideas is not confined to methods which are initiated and developed within the company. It also includes new applications of tools which are bought on the open market and which have been found exceptionally efficient.

WAR WINNER'S REPORT TO: Uncle Sam

Here's how I licked the problem of grinding bombs:



Plenty of dry, clean air was on tap. They didn't have to spend $832 for a HIGH-CYCLE converter.

Gave them a 26" extension grinder to reach inside the bombs (see sketch). This was 5 lbs. lighter on a power-for-power basis than my HIGH-CYCLE opponent.

Since the job required a lot of in-and-out handling, my lighter weight and simplified build got the decision to turn out the bombs faster.

AIR O'TOOL

(Winner, Round 8, Bout of the O'TOOLS)

"AIR" *helps us get at* TOKYO

Here, Rotor Air Grinders licked a problem of getting at the burrs inside bombs—to help U. S. bombers get at the Tojos inside Tokyo.

To make sure this grinding job would be done as thoroughly as the bombing job to come, the Rotor Analyst let AIR and HIGH-CYCLE decide which could turn 'em out fastest. Guesswork is out when the O'Tools have it out!

AIR won this Round 8. See his report.

Are you getting the kind of results from portable tools that can whip the Axis? Call in the unbiased Rotor Analyst to blast away the obstacles.

KEEP 'EM RUNNING! Get your free copies of the booklet and wall chart on maintenance of portable tools.

Use of Power Tools • Speedier Driving • No Slipping = 50% Less Assembly Time with Phillips Screws

Here's a way you can prove to yourself that Phillips Recessed Head Screws are "fast as greased lightning."

Check up on how many assemblies your crew handles in a day, using slotted screws. Then—give them a day's supply of Phillips Screws. Even without a change in *driving* method, production will go up. And since Phillips Screws end driver slippage, they can use power tools—with the result (on the average) that they can *double* their output.

You will *eliminate wasted effort* because the Phillips Screw clings to the driver; *prevent lost-time accidents* because screwdriver injuries are no more; and *get stronger fastenings* because Phillips Screws seat tight without heads splitting. In addition you save an average of 50% in *cost* as well as time.

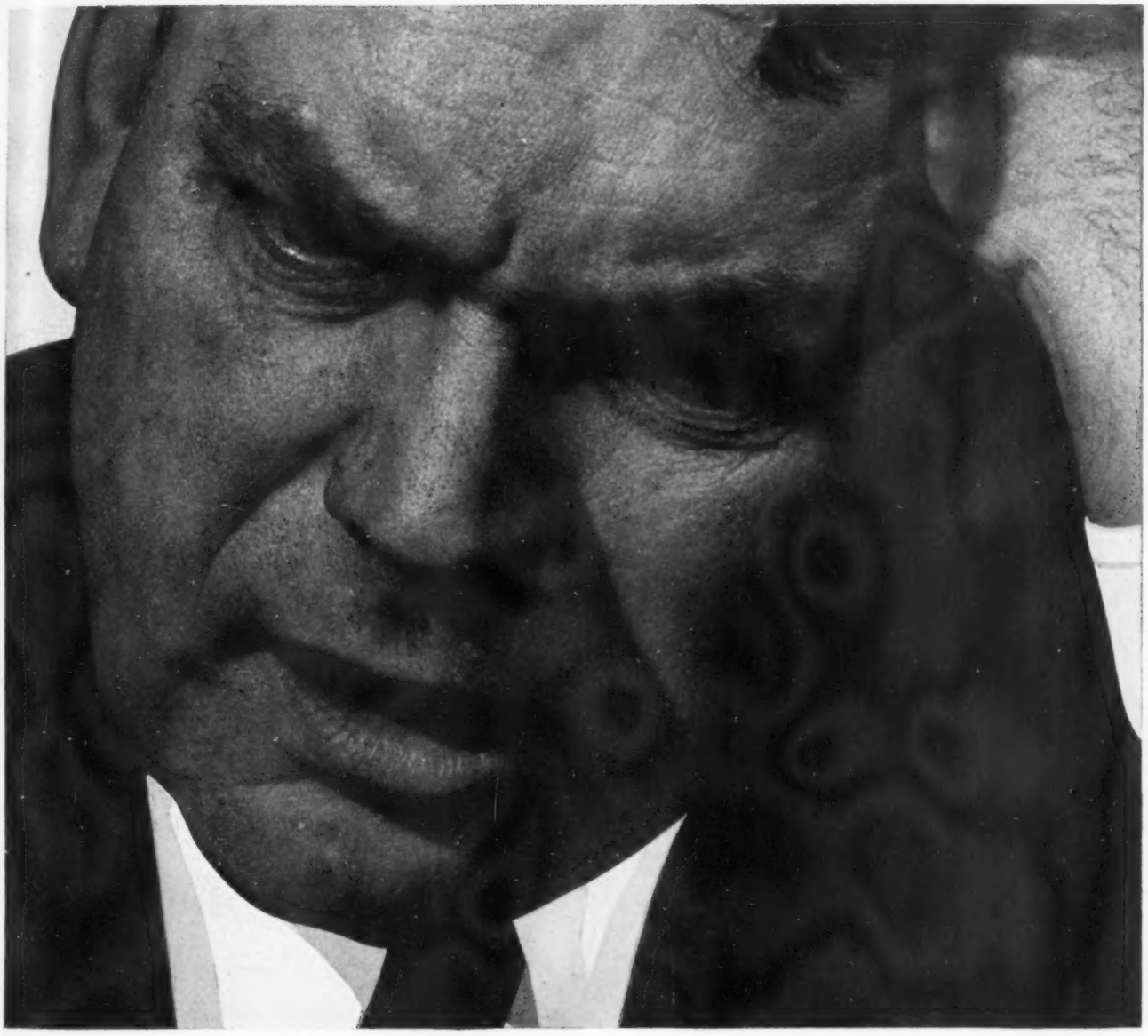
Any of the firms listed below can supply you

PHILLIPS RECESSED HEAD SCREWS

GIVE YOU 2 for 1 (SPEED AT LOWER COST)

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS • SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.



Have you the N.E. blues?

The high manganese content of the new National Emergency steels is posing new cutting oil problems almost every day. But tough as these new steels may be, there's a Shell Lata Cutting Oil to do the job . . . fast and well.

Shell Lata Cutting Oils are delivered to you ready for instant use. This eliminates any chance of a mistake in blending at the factory . . . insures uniformity at all times. And because every cutting oil job *is* different, Shell has developed a control technique that "balances" the oil for each particular job . . . fits the oil to the machine, the application and the tool.

Call in the Shell man now. Let him show you how this technique can cut machine down-time, improve surface finish, increase tool life in YOUR plant.

OIL IS Ammunition -USE IT WISELY

SHELL LATA OILS *for Cutting*

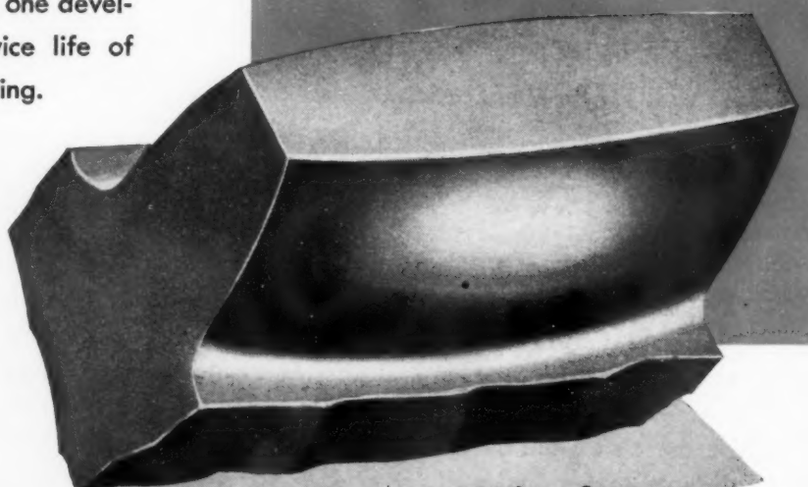
SHELL

MAGNAFLUX TEST *proves* SUPERIORITY OF SHAVED GEARS

Red Ring Rotary Shaving finishes gear tooth surfaces accurately—faster than other methods and without producing any of those microscopic cracks in the tooth surface which are so hard to avoid with other gear finishing methods—and which are so prolific of fatigue failures in service. A Magnaflux test on shaved aircraft gears shows this conclusively.

This Patented Rotary Shaving Process which provides the Elliptoid Tooth Form has done more than any other one development to increase the service life of gears by eliminating end bearing.

Red Ring Shaving is an automatic process that is fast and economical. No skill is required in machine operation. It may, but need not, be followed by Red Ring Crossed Axes Lapping.



Write for Descriptive Bulletins

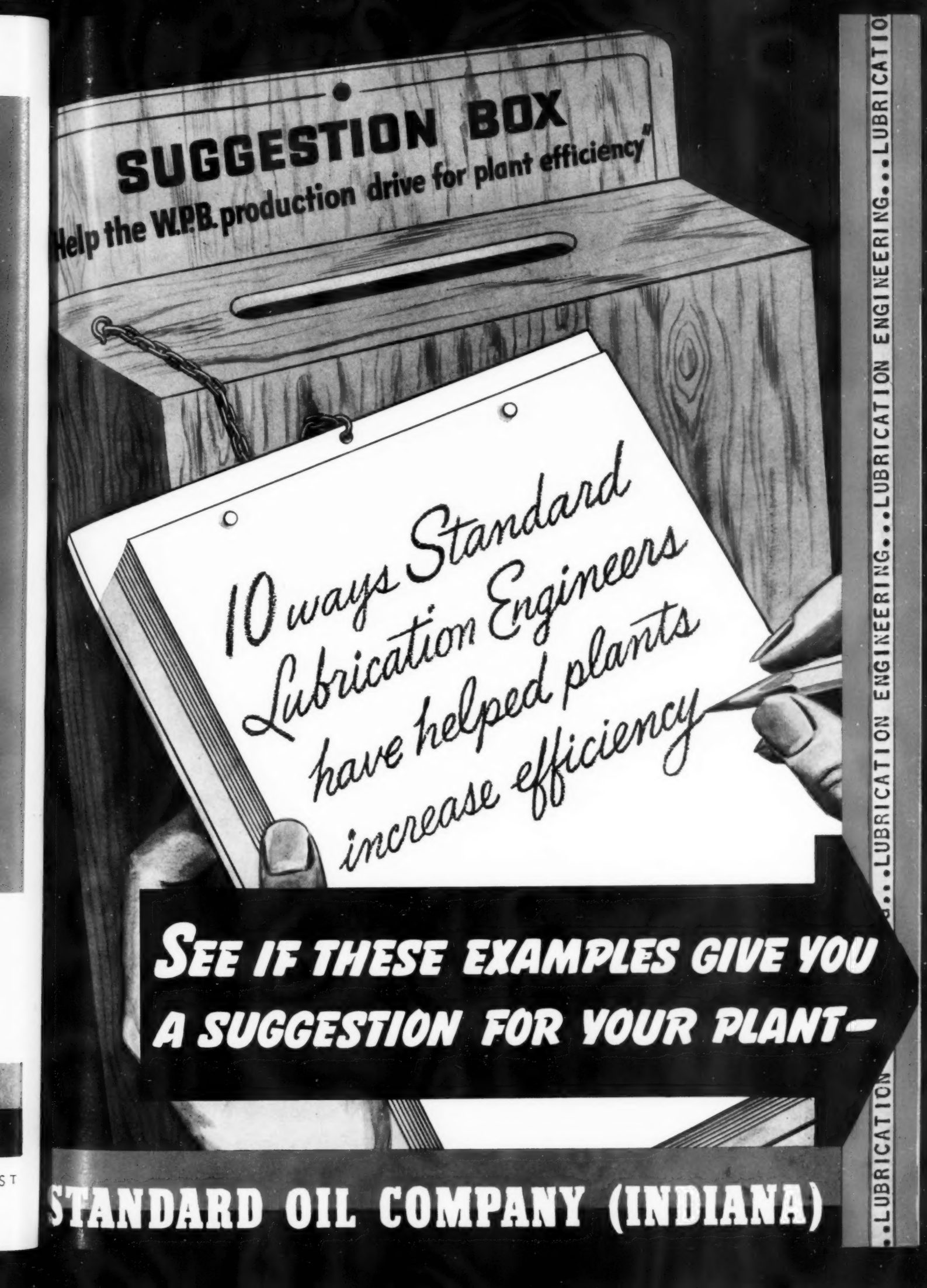
NATIONAL BROACH AND MACHINE CO.

RED RING PRODUCTS

5600 ST. JEAN · DETROIT, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS


SUGGESTION BOX
"Help the W.P.B. production drive for plant efficiency"
10 ways Standard Lubrication Engineers have helped plants increase efficiency
SEE IF THESE EXAMPLES GIVE YOU A SUGGESTION FOR YOUR PLANT—
STANDARD OIL COMPANY (INDIANA)
LUBRICATION ENGINEERING

Save TOOL LIFE

JOB—Forming, tapping, threading and cutting off 9/16 inch dia. leaded screw stock on automatics.

PROBLEM—Tools on the forming and cutting off operation lasted only 3 to 4 hours before regrinding.

RESULT—Tools lasted 6 to 7 hours when a highly sulfurized mineral oil was used at the recommendation of a Standard Oil Engineer.

JOB—Manufacture of shell forgings.

PROBLEM—Improve interior finish of shell and increase piercing-tool life.

RESULT—Special forging oil produced to carry solids in suspension in the oil to reduce abrasion and rapid deterioration of the piercing tool. At the same time it eliminated separation of solids from oil in storage. This special oil reduced carburizing of the tool, facilitated removal from the shell forging at each operation, and improved accuracy and finish of shell interior.

* * *

JOB—Machining coupling for hydraulic assembly for raising and lowering landing gear.

PROBLEM—Eliminating rough finish and rapid tool wear on tough aluminum alloy parts.

RESULT—Developed special cutting oil which gave maximum tool life and satisfactory finish with the elimination of odor development.

Save MACHINE TIME

JOB—Stamping operation above, using special alloy die.

PROBLEM—Excessive polishing of die—every 2,000 pieces —wasted machine and operator time.

RESULT—Engineer recommended a test of Stanostamp. At 2,000 pieces, the die was as good as new. At 25,000 pieces, there were still no signs of wear. Finally, 45,000 pieces were turned out before the die needed polishing.

* * *

JOB—Form grinding steel alloy gears for adjustable blade propeller assembly.

PROBLEM—Increase stock removal to speed production.

RESULT—Developed mineral oil with special compounding which eliminated burning of work at high wheel speeds and feeds, and reduced oil fog at high speeds.

JOB—Various machining operations on non-ferrous metals in munitions plant.

PROBLEM—Separation of the emulsified coolant. Loss of machine time for cleaning oil lines and supply tanks. Odor development in coolant.

RESULT—One machine was isolated and Standard Paste Compound tested. No deposits appeared. No rancidity or odor developed. The entire battery of machines now uses this product without any delay for cleaning.

Save PARTS SPOILAGE

JOB—Deep-drawing cartridge cases in munitions plant.
PROBLEM—Scratches on work. Periodically dies would pierce bottoms of cases.
RESULT—Replaced a plant-mixed stamping compound with Stanostamp. Eliminated rejected parts and waste. Reduced rusting of steel parts.

• • •

JOB—Stamping cartridge cases from sheet copper.
PROBLEM—Dies tended to "brass-up" and lose accuracy. Frequent changes needed.
RESULT—Stanostamp reduced "brassing" and also kept die wear to the minimum. Operation ran cooler and could be speeded up 10%.

JOB—Highly finished bearings and truck parts.
PROBLEM—Adequate rust protection for shipment overseas and in storage.
RESULT—Parts in storage were amply protected by dipping in Stanorust. Parts shipped overseas withstood rusting in salt-laden air, high humidity, and widely varying temperatures when swabbed with a heavier grade of Stanorust.

OIL IS AMMUNITION . . . USE IT WISELY

Save EQUIPMENT

JOB—Lubricating reduction gears and circulating systems.
PROBLEM—Reduce sludge formation, shutdowns for cleaning, and maintenance.
RESULT—Formerly cleaned reduction gear (above) and changed oil every three to six months. Oil now changed once a year and no deposits are found.

WHY EXPERIMENT? SEE A STANDARD OIL ENGINEER

These are just a few of the hundreds of new cutting oil and lubricating problems already solved by Standard Oil Engineers for plants converted to war production.

Profit by the experience these Engineers have had in other plants. Take advantage of the new cutting oils and new applications they have developed. Save time getting peak production from every machine and tool.

If your plant is located in one of the middle western states listed below, just call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

In Nebraska, call or write Standard Oil Company of Nebraska at Omaha.

NEERING...STANDARD OIL COMPANY (INDIANA)...LUBRICATION ENGINEERIN

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION EN

HERE'S HELPFUL INFORMATION ON LUBRICATION AND CUTTING FLUIDS

You may have taken over new duties—new men have been assigned unfamiliar jobs. Where cutting fluids or lubrication are concerned, these Engineering Bulletins will be helpful. They are briefly described below. Send for any you think will be valuable to you or your men.

Where you have specific lubrication or cutting oil problems, call a Standard Oil Engineer. He will have information on the latest developments in methods to solve your problem quickly.

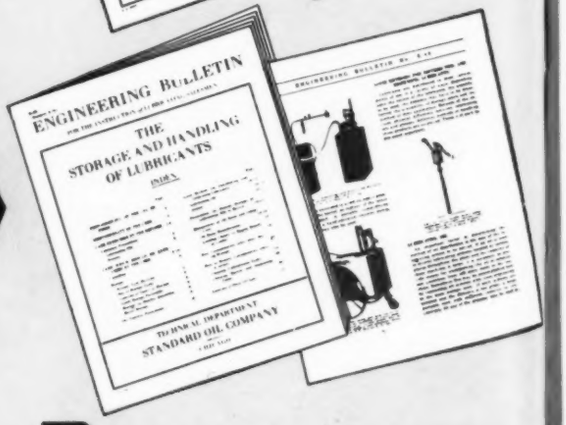
1 "METAL WORKING OPERATIONS —CUTTING, GRINDING, AND FORMING FLUIDS"

Contains the latest information on the action and functions of cutting fluids. Briefly describes various types of metal working operations and the kind of fluid generally recommended for them.

2 "BEARINGS AND THEIR LUBRICATION"

Discusses types of bearings and bearing materials—types of lubricants required by each of them—methods of lubrication—significant properties to be considered in selecting an oil or grease.

3 "STORAGE AND HANDLING OF LUBRICANTS"

Describes various causes of contamination of lubricants in storage and suggests ways to avoid it. Methods of oil room management are suggested, as well as ideas for distributing and dispensing lubricants to avoid mixing brands in application.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA) American Machinist
910 SOUTH MICHIGAN AVENUE—ROOM 1223
CHICAGO, ILLINOIS

Please send me Bulletin number .....

Name.....

Company.....

Address.....

City and State.....

PASTE THE COUPON ON A POST CA

Copies will be sent free if you are located in an the states listed below—or phone the nearest Sta ard Oil Company (Indiana) office in these state

COLORADO • ILLINOIS • INDIANA • IOWA • KA
MICHIGAN • MINNESOTA • MISSOURI • NORTH DA
MONTANA • SOUTH DAKOTA • WISCONSIN • WYO

In Nebraska, write Standard Oil Company of Nebras at Omaha.

CATION E

STANDARD OIL COMPANY (INDIANA

McKAY ELECTRODES HELP TO KEEP 'EM FLYING!

Welding plays a vital role in the production of our fighting ships of the air . . . not alone in the structural assembly but also in the guns, mounts, landing gears, instruments, engines and equipment.

In the great aircraft factories, and also in plants all over America from which flow essential and intricate aeroplane parts, *welding* speeds production in a "thousand-and-one-ways".

In many of these welding applications the superiority of the McKay "researched" line has been demonstrated beyond doubt. Thus McKAY WELDING ELECTRODES continued to SERVE as they SAVE . . . helping, to KEEP 'EM FLYING!

THE McKAY COMPANY · PITTSBURGH, PA.

PACIFIC COAST SALES OFFICES: 125 S. Santa Fe Ave., Los Angeles · 100 Howard St., San Francisco

The McKay line includes regular carbon steel, stainless, and alloy steel electrodes for every welding purpose. Literature on request.

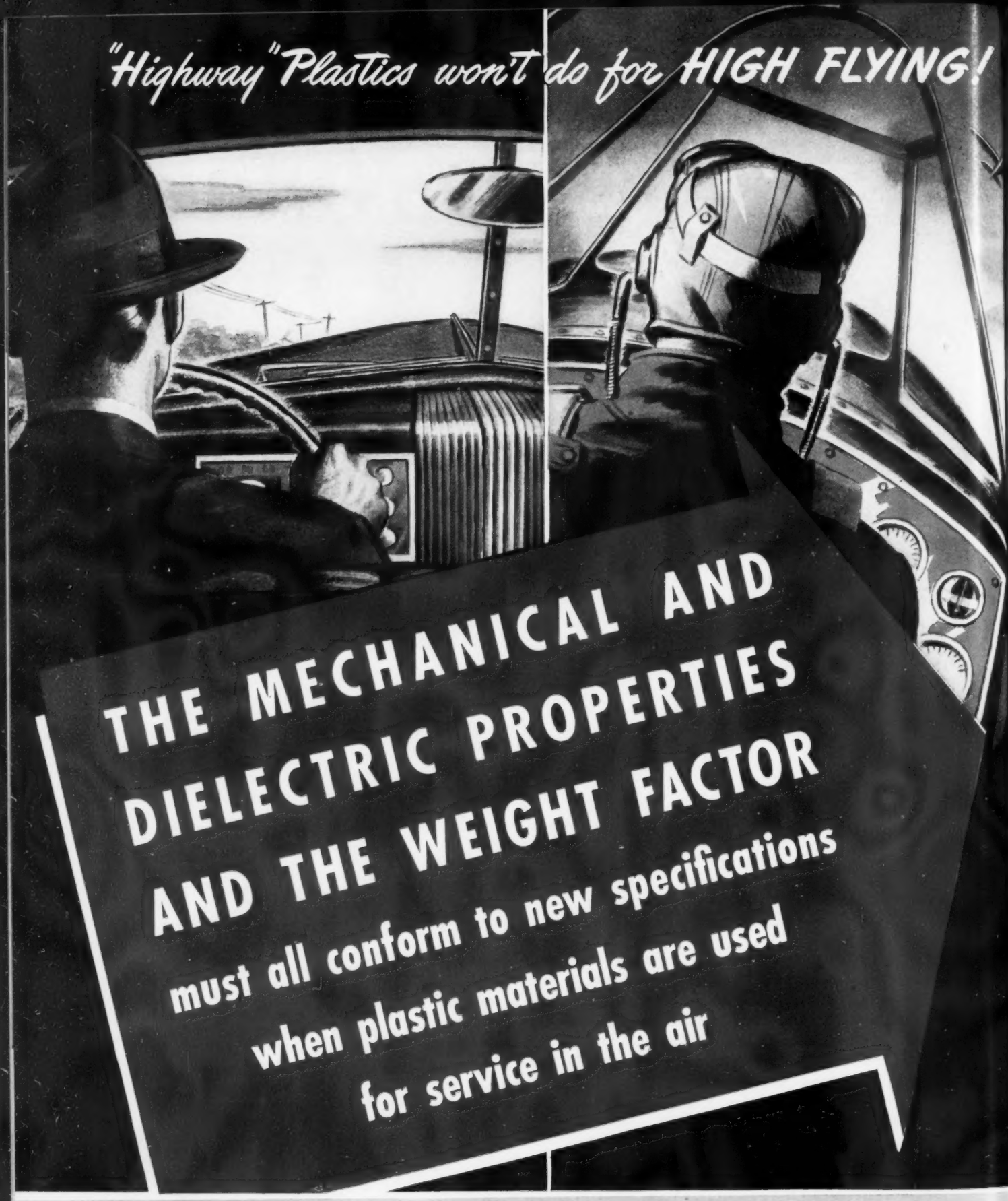
★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

★ The McKay Company was among the first honored with the coveted Navy "E" award for excellence in fulfilling Naval Ordnance contracts. ★

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

McKAY WELDING ELECTRODES

AND INDUSTRIAL, MARINE AND AUTOMOTIVE CHAINS


"Highway" Plastics won't do for HIGH FLYING!
THE MECHANICAL AND DIELECTRIC PROPERTIES AND THE WEIGHT FACTOR must all conform to new specifications when plastic materials are used for service in the air

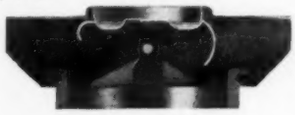
3 Ways "BAKELITE" PLASTICS HEADQUARTERS Help Speed Production

1 LITERATURE ON "DO'S" AND "DON'T'S" OF PLASTICS . . . Helpful technical booklets containing data on types and forms of BAKELITE plastics, and the most efficient methods of fabrication. This literature will help you to choose the right plastic for each job, save time and avoid errors.

2 GEARING OUR LABORATORIES TO YOURS . . . Bakelite Laboratories offer a two-fold service. They are ready to help you utilize present plastics in war production. They will also develop new formulas to help solve the problems of highly specialized requirements.

THIS PICTURE STORY of a molded component for aircraft engines illustrates how it is possible to meet these new requirements by combining the correct plastic materials with proper designing skill and fabricating technique.

1. Material "A," the first choice of materials for this electrical part, is a low-loss type of plastic used generally for radio insulation. But, the part failed in arc-over at reduced pressures due to high elevation and also in dielectric breakdown because of incorrect design. Also, as the sectional view shows, cracks occurred when the sprue was broken while opening the mold, caused by lines of weakness set up by improper flow properties of this material in this particular molding process.



2. By a radical redesign of the plastic part and its metal inserts, dielectric failure was remedied completely. However, cracking still presented a problem which the design engineers attempted to solve by switching to material "B," and by building a proper jig to remove the molded part squarely from the mold itself.

3. Yet, cracks still occurred when the metal sections were machined after molding. Material "C" was then tested in order to obtain better machining strength. Although this tougher plastic machined satisfactorily, there was still evidence of continued cracking over the "ears" of the molded piece.

4. By filing smooth the corners of the ring inserts before they were inserted in the mold, internal strains were relieved, thus eliminating some of the cracking difficulty. This combination of material "C" with the redesigned metal inserts proved satisfactory mechanically, but the material lacked the required dielectric strength.

5. It was thereupon decided to revert to material "B." However, in order to obtain the necessary mechanical strength, the metal inserts were again redesigned to offer less resistance to the shrinkage of the plastic material. In addition, a circumferential slot was turned in the ring insert to a proper depth which made it possible to machine the part after molding without exposing sharp corners. This corrected all cracking due to machining operations.

6. Despite this improvement, two types of cracks still occurred. One was a radial crack on the face of the ring originating at the small round center insert. Another was located in the recess of the base of the tower. The recommendation that preheating time be increased and that plasticity be changed from flow 100 at 300 lb. per sq. in. to flow 100 at 500 lb. per sq. in. resulted in definite improvement.

7. As a final step, the mold was redesigned to provide a more even distribution of the mass of the plastic material, and the area around the center insert in the face of the piece was reinforced with a BAKELITE phenolic molding blank. These changes reduced cracking to an absolute minimum. They also lightened the weight of the final molded piece — an important factor for producing parts for aircraft use.

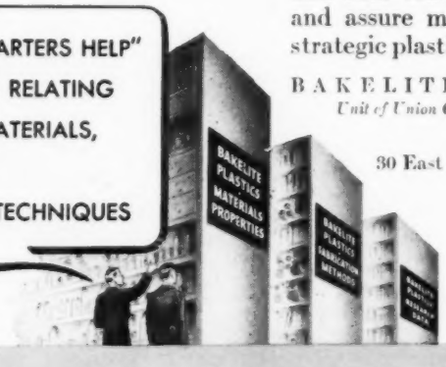
NOWHERE will you find higher standards of efficiency than in the engineering of automotive plastics. But plastics for combat flying are subjected to shocks, stresses, and climatic conditions that only products engineered for this service will withstand. Manufacture of parts that rate 100 per cent on *all counts* brings extreme problems that demand the closest co-operation between designer, materials' supplier, and manufacturer.

In the case of the aircraft component shown here, each requirement was met step by step . . . each new problem solved by experiment and test as it appeared. Molding materials were changed, and changed again, before one was found that would neither crack under unusual mechanical strains nor fail when subjected to severe electrical breakdown tests. Designs had to be altered, and revisions made in molding technique, in order to meet completely, on a productive basis, the necessary mechanical and dielectric requirements.

When you are confronted with problems such as these, Bakelite Plastics Headquarters can help to avoid costly and time-consuming experimentation, and assure maximum service life for strategic plastic products.

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York, N. Y.

GET "HEADQUARTERS HELP" ON PROBLEMS RELATING TO PLASTIC MATERIALS, DESIGN, AND FABRICATING TECHNIQUES



and Conserve Strategic Materials

3 FIELD WORK ON "FRONTLINE" JOBS . . . Located at important industrial centers throughout the nation, Bakelite Field Engineers are ready to give prompt service to manufacturers engaged in war production. Fully qualified, they can frequently solve production problems on the spot.

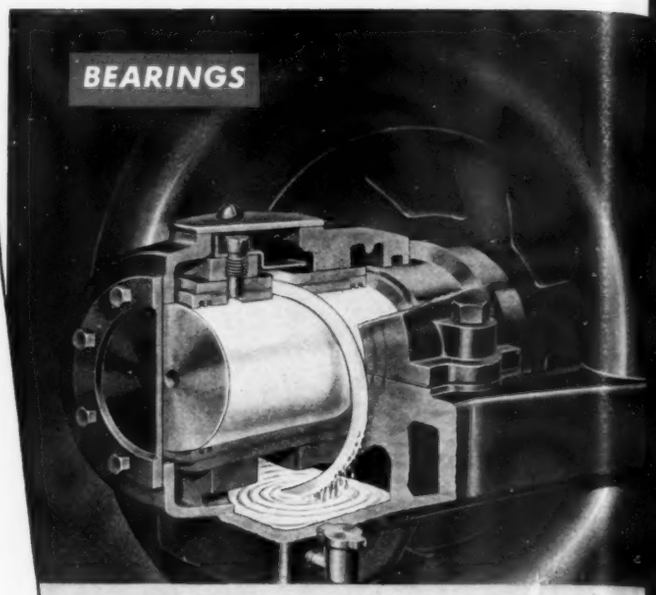
BAKELITE

The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

PLASTICS HEADQUARTERS

WHILE YOU'RE WORRYING ABOUT PRODUCTION...

YOU AND YOUR MEN are working hard for production... driving to meet shipping dates. You know your machines are being "driven"—often by "green" help. Wouldn't you welcome aid in making sure *every* machine is properly taken care of with Correct Lubrication?



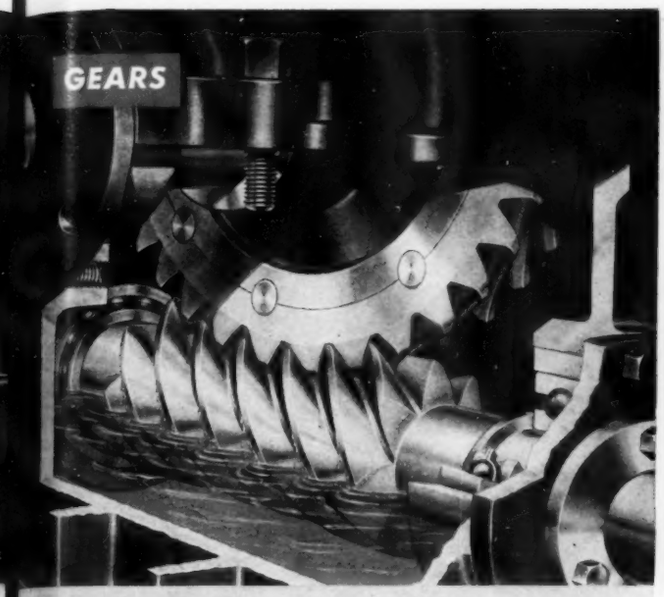
LOOKS SIMPLE—but size and type of bearing, speed, heat, load, method of application, all affect the choice of a lubricant. "Correct Lubrication" is a science! It demands skilled experience counsel.

Who's Looking Out f

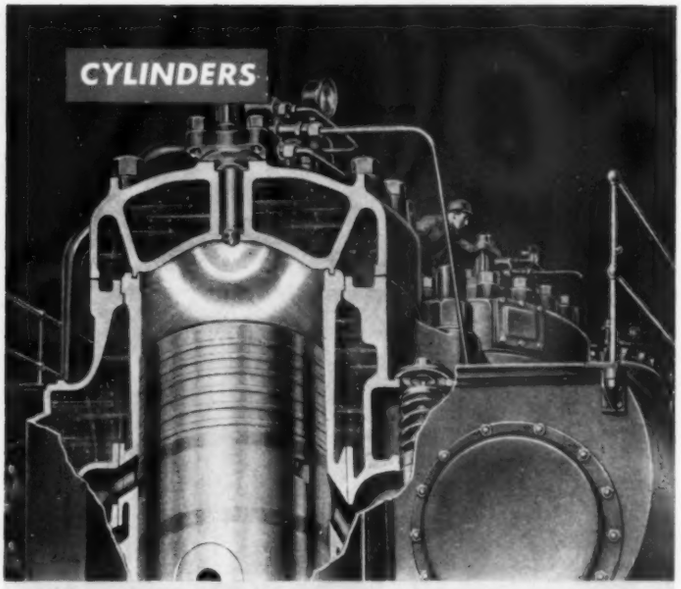
HERE'S A PLAN TAILOR-MADE FOR YOUR PLANT

THOSE TWO STEPS at the right bring you the sum of Socony-Vacuum's 76 years' experience, *the world's greatest*, in the lubrication field. Today, when there is no time for "second guesses" this knowledge is proving its value in helping industry do its biggest job!

1 LUBRICATION PLANNING—After careful study of your machines and their operating conditions, your Socony-Vacuum man will work out a guide of lubrication recommendations with your own engineers.



IRREPLACEABLE—Precision-made gears, in fact all production equipment, should be viewed as irreplaceable. This places an added burden on lubrication . . . emphasizes need for only the best!



DEPENDABLE POWER—The hum of your power plant is the heartbeat of your production line. Diesels, turbines, steam engines exist on "Correct Lubrication" as prescribed by a lubrication engineer.

for Your Machines?

2 LUBRICATION CONTROL—By means of this lubrication program . . . through the help of the Socony-Vacuum man . . . you will be freer to drive for more production. He will gladly help look out for your machines!

TO HELP MAINTAIN WARTIME PRODUCTION CALL IN

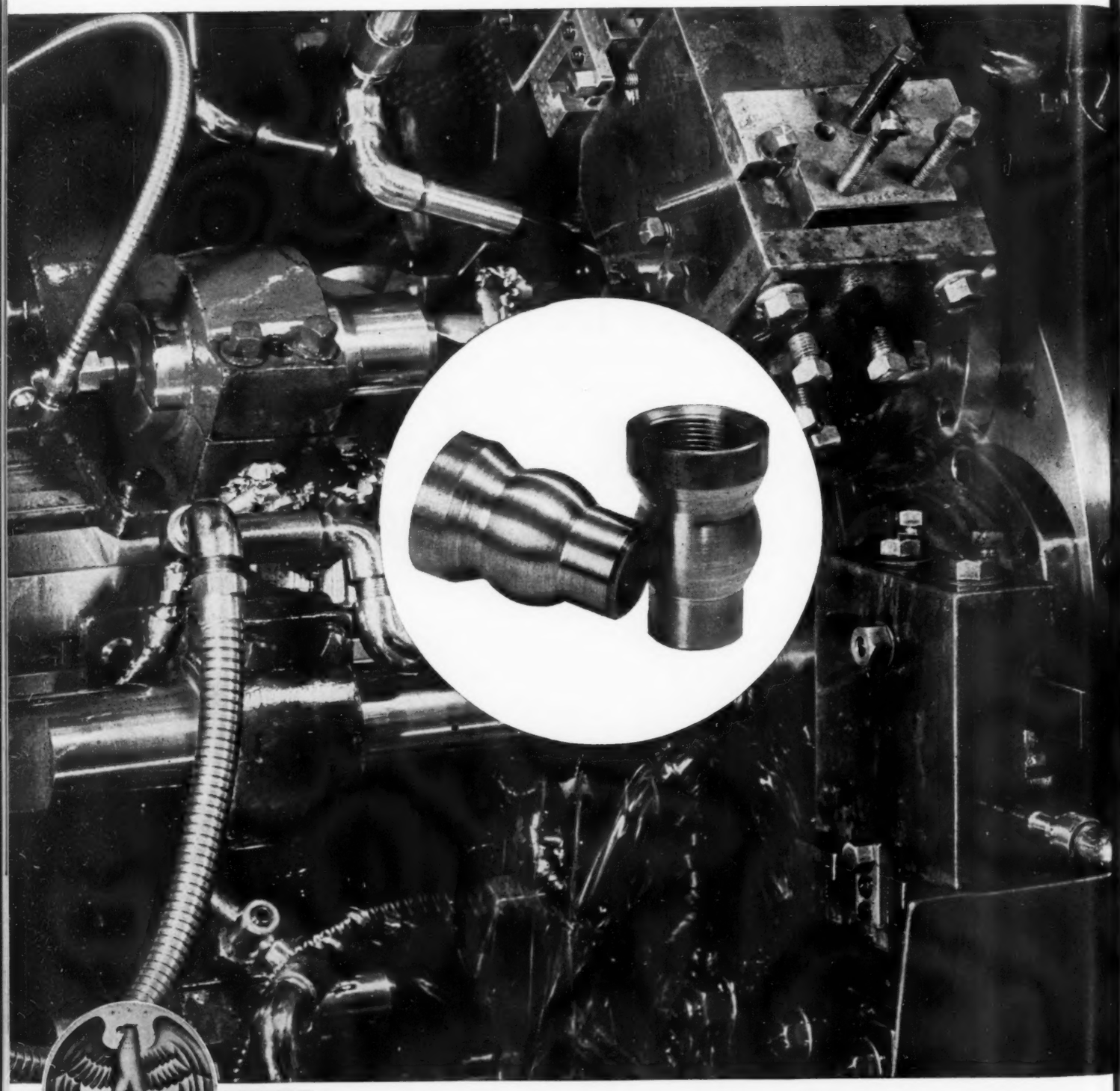
SOCONY-VACUUM

FOR *Correct Lubrication*

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC. • Standard Oil of N.Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

How a Useless Part



REPUBLIC STEEL
PRODUCTION FOR VICTORY

DS

REPUBLIC Union Cold

is Helping to Speed *War Production!*

In the circle on the opposite page you see a steel part. So far as actual application is concerned, it is absolutely worthless. It is a standard test part, designed to incorporate every common machining operation in its manufacture on an automatic screw machine.

But from another standpoint, this steel part has proved of inestimable value. During more than a dozen years immediately preceeding the present war, tons of steel of many analyses — standard and experimental — were cut up to produce millions of these parts on "automatics" working under all types of actual field conditions in one of our plants. And all the while, Union Drawn metallurgists and engineers were making intensive studies of the results.

The machining performance of each steel, the rate of feeds and speeds, the machined finish obtained, resulting tool life and production time, were accurately recorded. Variations were thoroughly investigated to learn all the "whys and wherefores" of the machinability of steels.

Time after time, the findings from this continuous test resulted in improvements in the machining characteristics of Union Cold Drawn Steels — thus increasing output, improving quality, lengthening tool life and reducing costs. Frequently, the information acquired was applied to a steel parts manufacturer's particular problem. And these same studies formed the basis for determining the tables of recommended cutting speeds and feeds for various steels in the Union Drawn Steel Handbook.

Now, because of the urgent demand of war production for steel, the manufacture of this test part has been temporarily discontinued. But the vast store of machining information learned from it is helping speed war production wherever automatic screw machines are turning Republic Union Cold Drawn Steels into steel parts for armament.

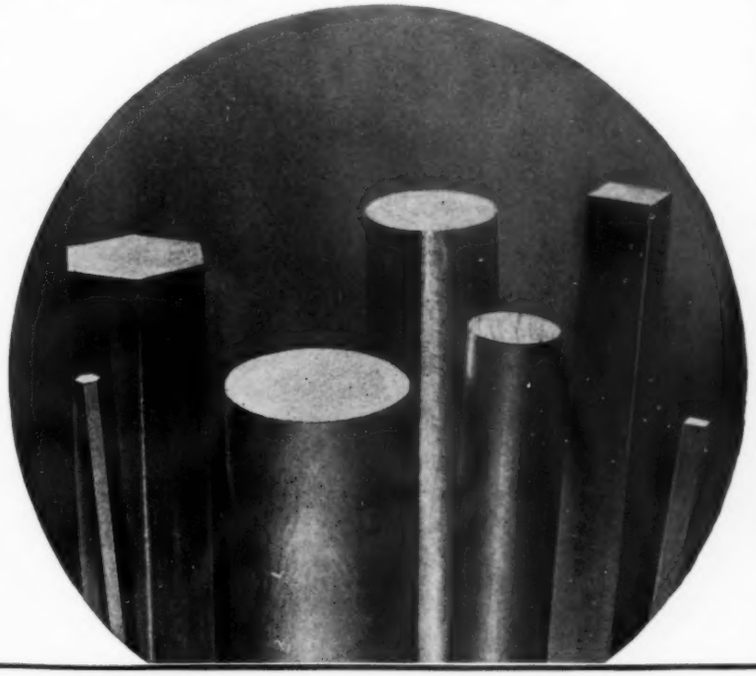
The output-increasing machinability of Republic Union Cold Drawn Steels is as high or higher than ever before. Union SUPERCUT — a development of Union Drawn metallurgists — is the fastest-cutting Bessemer screw steel made today. And the Union Drawn Steel Handbook now in the hands of operators in countless plants is helping them break previously high production records. Do you have a copy of this new handbook, No. 42? If not, write for one.

UNION DRAWN STEEL DIVISION

REPUBLIC STEEL CORPORATION

MASSILLON • • OHIO

Berger Manufacturing Division • Niles Steel Products Division
Steel and Tubes Division • Culvert Division • Truscon Steel Company
Export Department: Chrysler Building, New York, New York



Drawn Steels

Free-Machining Bessemer, Open-Hearth and Electric Furnace Steels

•

Union Cold Drawn Special Sections

•

Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Shafting).

War Supplies Cannot Be Made by Men Who Cannot See

GIVE YOUR WORKERS AO GOGGLES

Last year, eye accidents took from the War Production Program, 9,455,000 man-days . . . enough time to build 600 bombers, or 15 destroyers, or 8,000 light tanks.

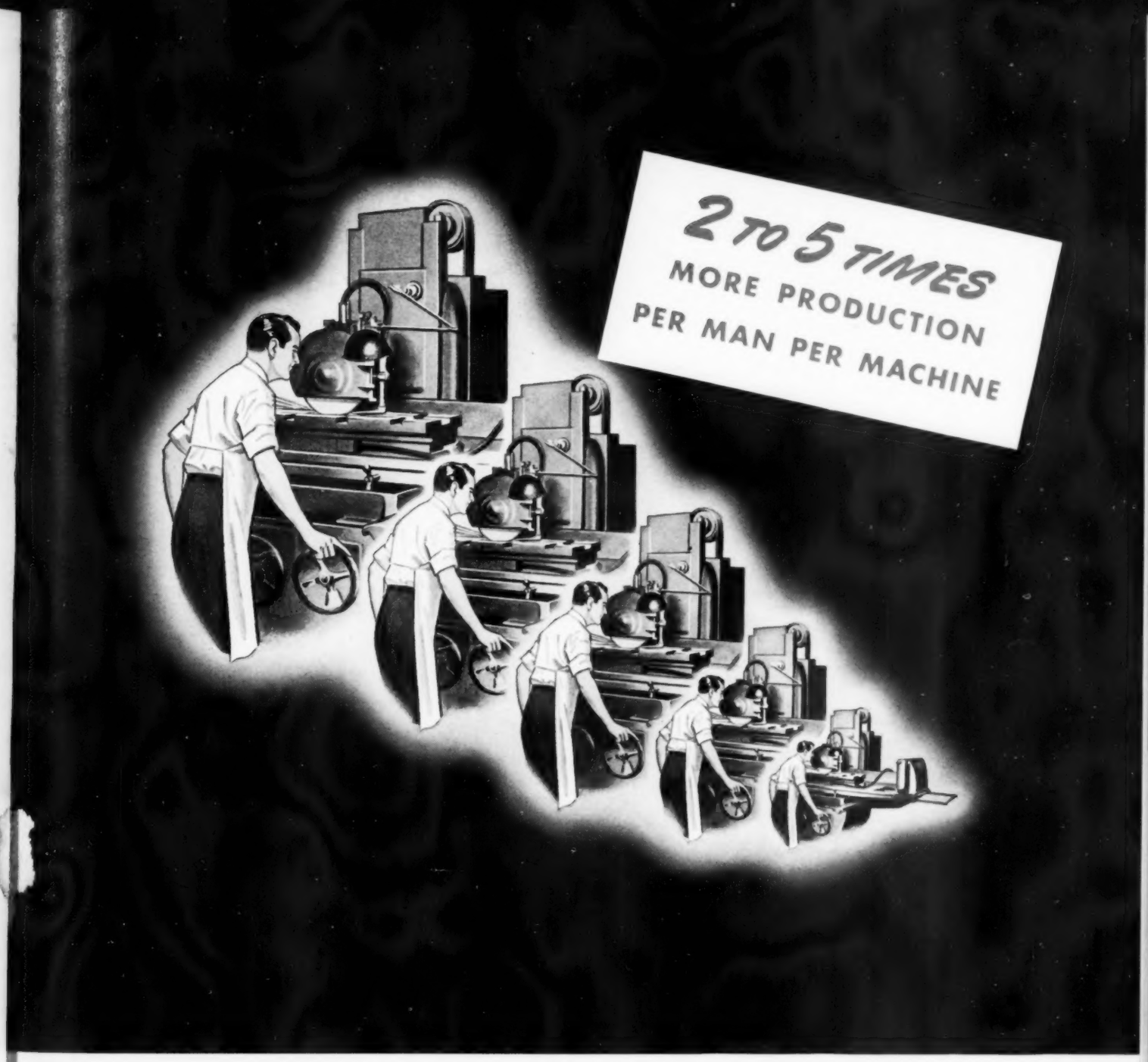
A flying chip will drop a worker from your ranks as quickly as an enemy bullet and upset production rates for a machine, a section, a department. That is *one* reason it more than pays to give all your skilled workers AO Goggles.

American Optical Company, manufacturers for more than 100 years of products to aid and protect vision, offers you a complete line of goggles to meet every type of industrial eye hazard. AO Goggles are comfortable to wear, lightweight and ventilated. Equipped with Super Armorplate lenses, AO Goggles offer maximum possible resistance to impact. Have your Safety Director call our nearest Branch Office, today.

American Optical

COMPANY

SOUTHBRIDGE, MASSACHUSETTS



A new Grinding Wheel that practically eliminates an old bugaboo called "burning"

Copyright 1942 by A. P. DE SANNO & SON, INC.

ONCE IN A WHILE a development comes along that knocks old ideas into a cocked hat. That has just happened to grinding wheels. A new wheel, named Por-os-way, is taking cuts you never dreamed of before, stepping up production per man per machine 2 to 5 times and practically eliminating burns.

The success of the Por-os-way wheel is the result of an entirely new structure. The Por-os-way wheel has millions of air cells that cool each grinding point. Yet the wheel—for all its porosity—is tough and strong due to a new vitrified bond and a "stringy" texture produced by an exclusive patented process. You can see the difference easily with your naked eye but you'll have to try Por-os-way to believe how much faster, cooler and free cutting it works, how it holds its corner, and how little dressing it requires.

Try the Por-os-way wheel on hardened tool and die steels, and on softer materials such as tin, aluminum, copper, wood, rubber and plastics. Write today for a trial demonstration. A. P. DE SANNO & SON, INC., 430 Wheatland Street, PHOENIXVILLE, PENNSYLVANIA.

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

(TURN PAGE, PLEASE)

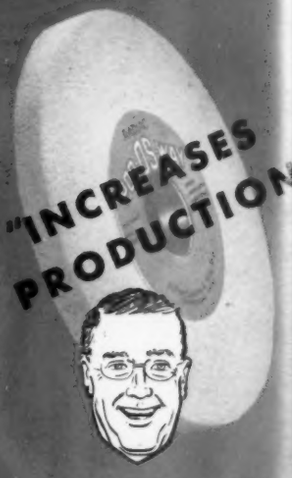
A NEW GRINDING WHEEL THAT IS

8 WAYS BETTER

The new Por-os-way wheel in actual production tests has removed stock 100 to 400% faster than ordinary wheels.

Por-os-way resists loading on hardened tool and die steels and soft materials such as aluminum, copper, plastics and tin.

The structure of the Por-os-way wheel is cool, porous, made by a new, patented process which required 3 years to perfect.



Por-os-way boosts production 2 to 5 times per man per machine. It helps to solve shortages in labor and machines.

Because of a tough new vitrified bond the Por-os-way wheel holds its corner and requires only a minimum of dressing.

Cool cutting action, minimum dressing enable Por-os-way to outlast other wheels and reduce number of wheel changes.

The Por-os-way wheel costs more but repeated checks show that, properly operated, it is worth many times its extra cost.

Aerated structure of Por-os-way wheel cools each tiny grinding point between contacts virtually eliminates "burns"

A. P. DE SANNO & SON, INC.,
430 Wheatland Street, Phoenixville, Penna.

I'm interested in knowing more about the Por-os-way Grinding Wheel. Please send me descriptive folder.

*Name*_____

*Company*_____

*Position*_____

*Street*_____

*City*_____ *State*_____

POR-OS-WAY* *a new* **RADIAC* PRODUCT**

*T. M. REG. U. S. PAT. OFF.

A. P. DE SANNO & SON, INC., 430 Wheatland Street, PHOENIXVILLE, PENNA. - SINCE 1893
Offices and Warehouses in New York City, Pittsburgh, Cleveland, Detroit, Chicago, Los Angeles

Actual Tests in America's war plants prove Marathon Cutting and Grinding Oils speed up production, cut costs, prolong tool life

In a large shell producing plant, taps formerly had to be reground every eight hours. As this is written, taps have been used eleven days without regrinding, since changing to Marathon C-16-70 Cutting Oil.

An important airplane parts plant reports that since switching to Marathon C-6 Cutting Oil, grinding time per piece has been reduced from 88 to 44 minutes; work speed increased from 2 R.P.M. to 4 R.P.M.; dressings required cut from 16 to 4.

These are not isolated cases. They are typical performances. They give you an idea of what you may expect when you put the recently developed Marathon Cutting and Thread Grinding Oils on the job. Get the facts—fast. Call in an Ohio Oil Company Lubrication Engineer to specify cutting and grinding oils that will boost production, increase tool life, save time, cut costs throughout your plant. Phone, wire or write, today.

C-16 CUTTING OIL is clean, transparent—operators can actually read a scale through it. Its lower working temperature means greater accuracy, less spoilage.

The OHIO OIL COMPANY, Inc.

GENERAL OFFICES: FINDLAY, OHIO

District Offices: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

A COMPLETE LINE OF CUTTING AND GRINDING OILS FOR EVERY REQUIREMENT

PRODUCERS OF PETROLEUM SINCE 1887

early delivery

MOREY 8" VERTICAL SHAPER

EQUALLY EFFICIENT IN YOUR TOOL ROOM OR MANUFACTURING DEPARTMENT

features

Precision . . . Easily handled—your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control . . .

Also built in 12" and 14" sizes

DESIGNED AND BUILT BY **MOREY MACHINERY CO., INC.**

Ask for Circular No. 726

410 BROOME STREET NEW YORK, N.Y.

Save Time and steel with tools of

MO-MAX

TRADE MARK REG. U.S. PAT. OFF.

MOLYBDENUM-TUNGSTEN HIGH SPEED STEEL

Boring Worm Gear Housing—
a typical job for MO-MAX.

The urgency of the emergency demands the utmost of every man, machine and minute. To get utmost production in metal cutting, use tools made of MO-MAX. They stay sharp—20% longer between grinds than 18-4-1.

Thousands of tons of MO-MAX used during the past decade prove this steel is today's clear answer to the call for more production with less use of strategic materials. MO-MAX depends only on the U.S.A. for its moly and its less than two percent of tungsten. Its one percent of vanadium is the lowest of any commercial high speed steel.

To its high red hardness, toughness, weldability and heat treatability, add availability. Fourteen leading steel makers can supply you. They are listed on this page. Write any of them or us for complete technical data. The Cleveland Twist Drill Company, Cleveland, Ohio.

LMW . . . Allegheny Ludlum Steel Company
MOHICAN . . . Atlas Steels, Ltd.
BETHLEHEM HM . . . Bethlehem Steel Company
MO-CUT . . . Braeburn Alloy Steel Corporation
STAR MAX . . . Carpenter Steel Company
MOLITE 8 . . . Columbia Tool Steel Company
REX TMO . . . Crucible Steel Company of America
DI-MOL . . . Henry Disston & Sons, Inc.
REX TMO . . . Halcomb Steel Division Crucible Steel Company of America
MOGUL . . . Jessop Steel Company
TATMO . . . Latrobe Electric Steel Company
S.T.M. . . . Simonds Saw and Steel Company
MO-TUNG . . . Universal-Cyclops Steel Corporation
VUL-MO . . . Vulcan Crucible Steel Company

2570

WE CAN'T DO A THING 'TIL THE CARPENTERS BUILD THOSE WORK-BENCHES ...PRODUCTION IS SURE HELD UP!
YOU SHOULD HAVE ORDERED "HALLOWELL" READY BUILT STANDARDIZED WORK-BENCHES

This will never happen to you, if you choose.. HALLOWELL

Fig. 928. "Hallowell" Work-bench. Laminated wood top. Drawer is extra.

SHOP EQUIPMENT

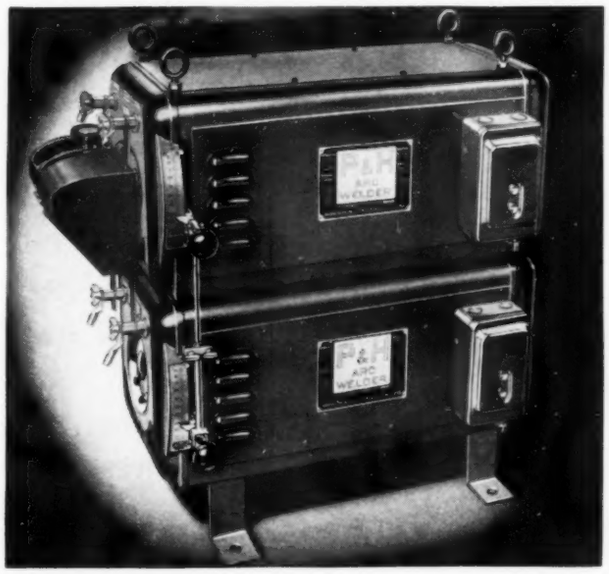
You can standardize on "Hallowell" Work-benches throughout your shop. Just choose the benches you need from the 1367 combinations available. Spare yourself all the trouble involved in building your own benches . . . no figuring and ordering lumber. "Hallowell" Benches are delivered promptly and ready to set up. Parts fit perfectly and are interchangeable. When placed they stay firm and rigid without costly, time-taking bolting to the floor. Tops are of smooth laminated wood, Masonite or steel if it's advantageous. Locked drawer units protect workers' tools. Get our Catalog for styles and sizes.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 · BRANCHES: BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO

I QUIT WORRYING ABOUT ARC VOLTAGE—

Yes, *one control* on this true welding generator gives you any desired welding current. Volt-ampere regulation is automatic. You don't have to fool around with dials, gadgets and other special adjustments. And it handles bare or coated electrodes equally as well.



Awarded the Navy "E" for excellence in war production, **P&H** *displays it also as a pledge of future effort.*

P&H-HANSEN
SQUARE FRAME WELDERS

When stacked for multiple hook-up as shown here, you still have but one control — one adjustment — for any welding current. Units can be cut in and out of parallel to serve one or more operators. This more flexible service cuts your investment in welding equipment. Ask for Bulletin W-26.

P&H *FOR ALLOY ELECTRODES*

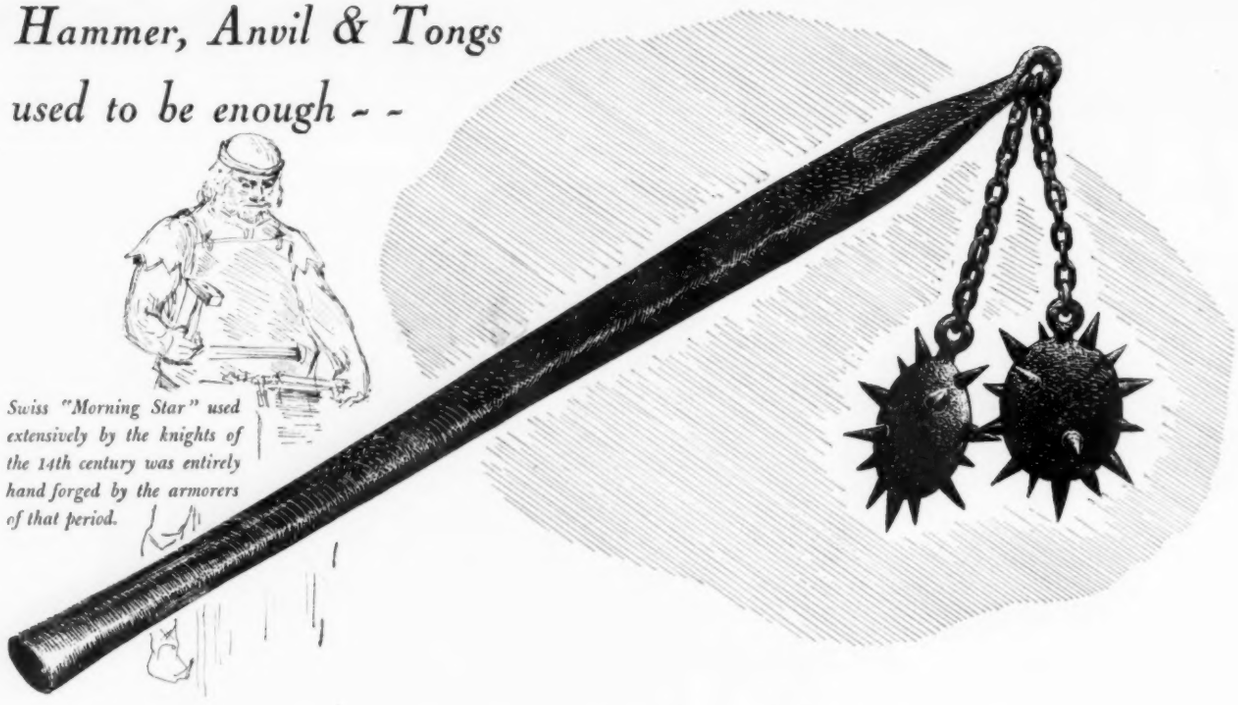
For welding high-strength steels, stainless, or 4-6% chrome steels, for hard surfacing, resistance to impact, abrasion, and numerous other services, including the welding of armor plates. Prompt deliveries are possible on sufficiently high priorities.

General Offices: 4514 W. National Ave., Milwaukee, Wis.

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Hammer, Anvil & Tongs
used to be enough - -



Swiss "Morning Star" used extensively by the knights of the 14th century was entirely hand forged by the armorers of that period.

- - BUT PRODUCTION OF MODERN WEAPONS DEMANDS DEPENDABLE TOOL STEELS

Tool steel plays an essential part in every step of the complex manufacturing operations required to complete the tanks, planes, ships, guns and all the other implements of modern warfare. Tool steel performance must be dependable to avoid loss of production, time and the waste of materials. Coppco tool steels are making good dependability records. We would like to discuss your tool steel requirements with you.

FOR DEPENDABLE PERFORMANCE..

COPPCO
TOOL STEELS

THE WILL TO MAKE GOOD STEEL

COPPERWELD STEEL COMPANY • WARREN, OHIO

87% OF OUR TIN IMPORTS TEMPORARILY CUT OFF!

Until the Allied colors wave again over the Malays and the Dutch East Indies, we all have to conserve our tin supplies.

For this reason we developed

"REX" BABBITT METAL

with the maximum 12% tin content limited by government regulations. Every bar is backed by our 68 years' experience in the development and manufacture of dependable Babbitt metals.

For most purposes, REX will do a very creditable job as a substitute for high tin base Babbitt, provided the lining is properly applied and the bearings are carefully fitted and lubricated. Try it!

Proudly the "E" Pennant waves over our plant, awarded to us and our fellow workers by the U. S. Navy for the production of naval ordnance.

The Physical Properties of REX BABBITT METAL

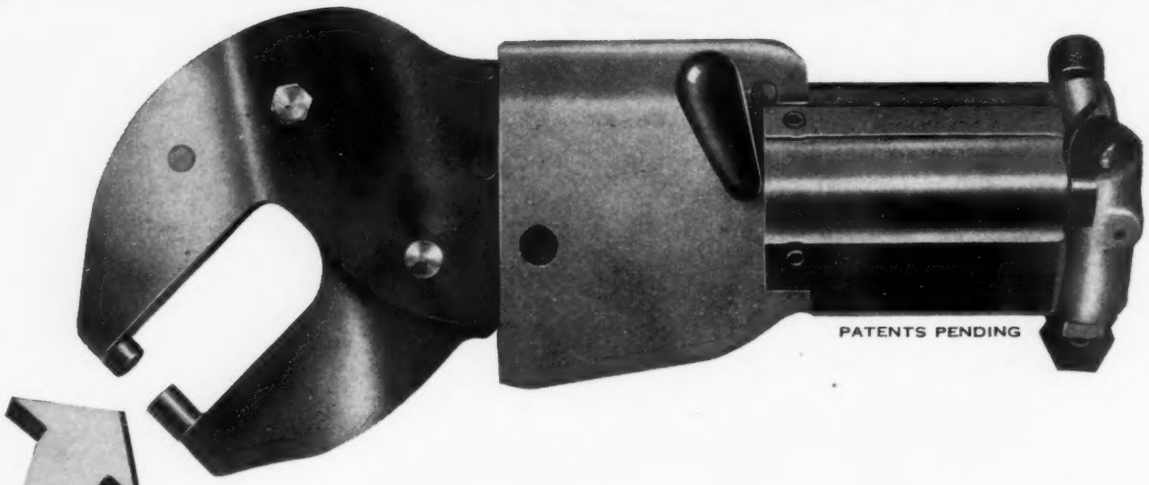
Tensile strength (lbs. per sq. in.)	8,200
% Elongation in 2"	1.2
Red in area %	1.8
Compressive strength (lbs. per sq. in.)	17,500
Specific gravity	9.60
Brinell hardness	25.0
Proper pouring temperature Drg. F.	625°-675°

NATIONAL BEARING METALS CORPORATION

ST. LOUIS • NEW YORK

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.

New CLECO 41-L Squeezer

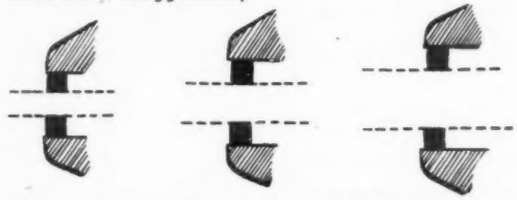


with parallel jaw action

THAT INSURES BETTER RIVETING

★ The faces of the riveter arm dolly and the anvil arm dolly of the Cleco 41-L Alligator Squeezer are *always parallel regardless of the amount of gap.* This exclusive feature prevents disalignment ("clinched rivets") and loss of rivets; it insures tight rivets with uniform heads, and does not cause distortion in the surrounding metal. ★ The 41-L is new in design, but is built to the same uncompromising quality standards that have distinguished Cleco Tools for so many years. This squeezer is light and powerful; it weighs only 5½ lbs., is 12¼″ long, and has a ⅛″ rivet capacity. The working gap is 15/16″, with full opening of 1½″. It is equipped with automatic return throttle, and adjustable pressure "pop-off," as well as return limit stop on alligator jaw. ★ To meet your wartime production schedule you can't afford to be without this unique squeezer. *Write now for complete information.*

● These sketches show how the faces of the dollies on an ordinary squeezer are parallel when the gap is small. But as the gap increases, the faces cease to be parallel. (For the purposes of illustration, the angles have been exaggerated.)



● In contrast, note how the faces of the dollies on the 41-L Squeezer are *always* parallel regardless of the amount of gap.

● The New Repairable Cleco Sheetholders with Latest Design Pliers.

THE CLEVELAND PNEUMATIC TOOL CO.

BRANCH OFFICES IN ALL PRINCIPAL CITIES

MARBLE AVE., AT EAST 77th ST. CLEVELAND, OHIO

MOTOR CONTROLS
for every kind of machine

Complex or Simple

General Purpose

Corrosion Proof

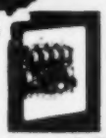
Water Tight

Non-Haz. Dusts

Non-Cor. Gases

Corrosive Gases

Hazardous Dusts


Wall Mounting

Pedestal Mounting

Complete Panels

Reversing

Automatic

Manual

Combination

Multispeed

Relay

Each motorized machine has its own operating cycle . . . its own working conditions . . . hence its own control requirements. To meet the demand for "standard" controls that will fit "special" applications, the Allen-Bradley line comprises an amazing variety of controls and accessories.

Standardized A-B control units can be made up in special panels for complex machines or supplied in various enclosures for simple, one-motored machines. A few of the many units and enclosures in the A-B line are shown on this page. Write for bulletins.

9 Types of Enclosures

The surest way to get long, trouble-free starter operation is to select the correct type of enclosure for each installation condition. The A-B line has an enclosure for every type of service.

Complete Panels

When motorized machines require inter-connected control, a multiple unit panel is the logical answer. Let A-B engineers work out your special control requirements with standard A-B controls.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL FOR ALL INDUSTRIES

QUALITY

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Two hundred ampere double pole relay with cover removed to show contacts.

ALLEN-BRADLEY RELAYS for WAR SERVICE

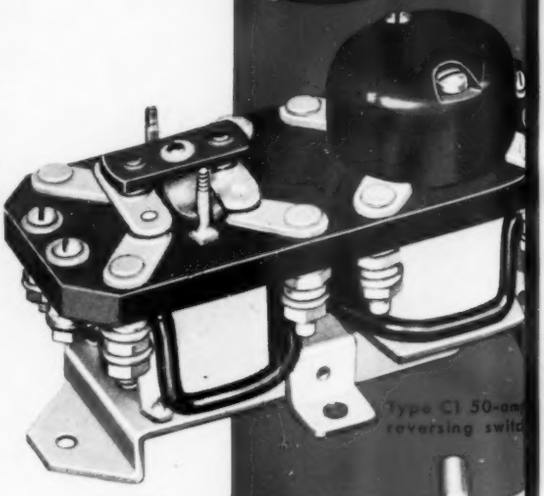
HERE is a line of exceptionally rugged solenoid relays, designed for war service on aircraft, boats, tanks, etc., that meets Army Air Corps specifications. All relays withstand 10G acceleration, operate in any position, and have dust-tight contact covers.

CONTACTS are special Allen-Bradley cadmium silver alloy. High contact pressure positively prevents chatter under Air Corps vibration test. Terminal blocks and contact covers are of macerated canvas bakelite . . . coils are protected with thermo-plastic varnish.

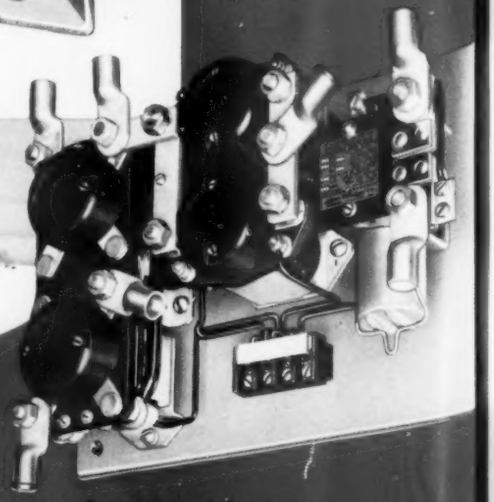
RATINGS—50, 100, and 200 amperes, 24 volts, single or double pole. All current ratings are good for elevations up to 50,000 feet. Available also as reversing switches and in special panel arrangements.

Allen-Bradley Company
1310 S. Second St., Milwaukee, Wis.

100-Amp single po relay.



Type C1 50-am reversing switc



Control panel for hoist service on tank lighters.

A-B Quality

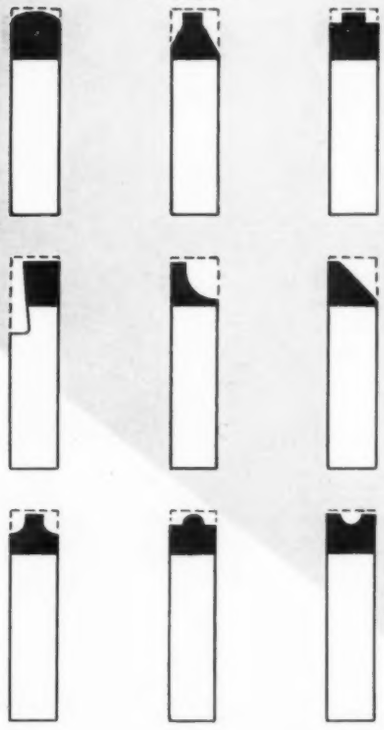
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

5-METHOD
COMPLETE TOOL SERVICE for MAXIMUM PRODUCTION

Many simple form tools from any of the Standard Tools

VASCOLOY-RAMET
STANDARD TOOL
STYLE 15



In the extensive use of carbide tools in any shop, there will be instances where simple form tools are required.

The accompanying illustrations show only a few such tools that have been made from standard tool Style 15. When you consider all the standard tools that are available in this Method One and the many shapes that can be made from each tool, the number of operations that are handled with these standard tools and modifications of them is limitless.

Simplified tooling practice recommends this Method One wherever possible. Vascoloy-Ramet Standard Tools will simplify and speed-up your tooling work. The standard tool most closely meeting requirements is withdrawn from stock and ground to the desired shape.

For fast tooling, keep in stock a supply of Vascoloy-Ramet Standard Tools. Catalog VR-421 will help you select the standard tools you should have. Write for your copy.

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

4255

TANTALUM-TUNGSTEN CARBIDE

FOR TOOL SERVICE..... *Specify* Vascoloy RAMET TOOLS

TANTUNG "G"

Consolidated....

Officials of The Consolidated Aircraft Corp., makers of the famous Consolidated giant four-motor bombers known in Great Britain as "Liberators", are using numerous tools made of Graph-Mo Steel. They report excellent success with Graph-Mo tools and dies, and are especially well pleased with the machinability of Graphitic Steel.

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Where there's a Production Milling Job to be done . . .

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The machine for exactly fitting the requirements of your milling job may never have been built. However, if a machine can be developed which will increase production, Fitchburg will design and build it, because high production milling machines are our specialty.

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The Open-Side Milling Machine shown here is an example of individually engineering a machine for a special operation. In this case the machine was designed and built by Fitchburg for milling parts of a Diesel Engine. If the parts had been for cannon or other war material, Fitchburg would have designed this machine and its tooling accordingly and with definite assurance of high speed production.

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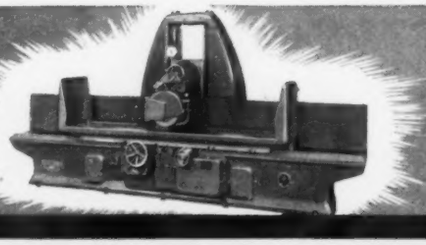
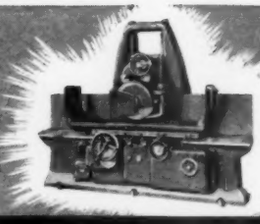
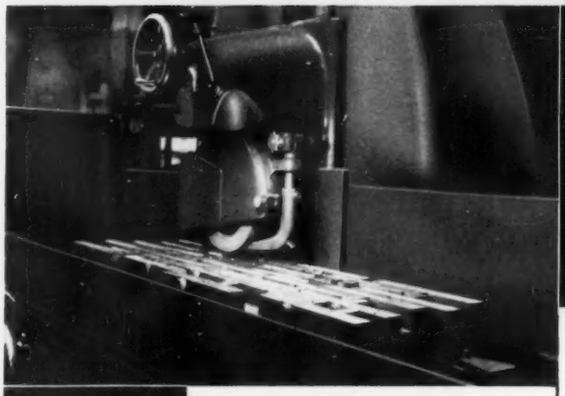


MATTISON
HIGH-POWERED PRECISION SURFACE GRINDER



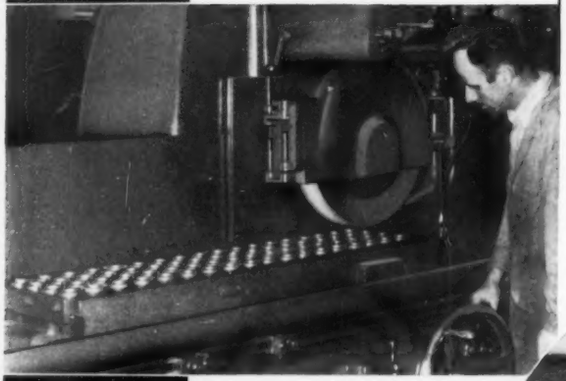


Large Table Space Means More Pieces per Load and GREATER PRODUCTION

● Cross Slide Draw Bars formerly ground 5 pieces at a time. Now ground on a Mattison Grinder 27 pieces per load. 50% time saving.

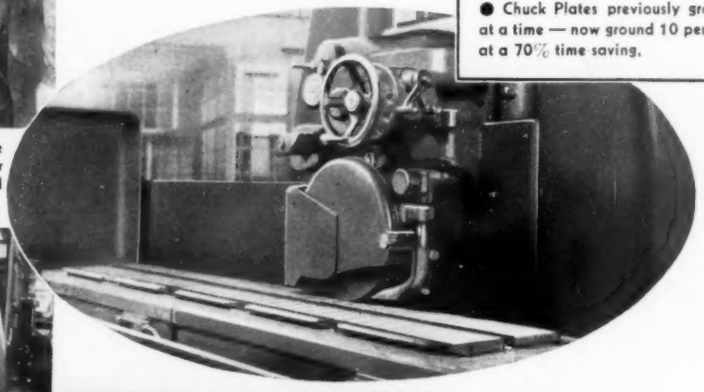
Examples: Grinding 75 pieces per load instead of 18 — cut time 80% . . . . . 10 pieces per load instead of 2 — cut time 70%, etc.

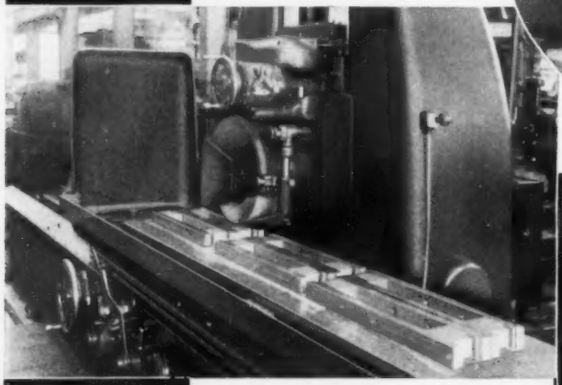
Jobs shown indicate the possibilities for increased production by handling large quantities per set-up. In your efforts to obtain maximum production, it will pay you to check into the capabilities of the Mattison Grinder.



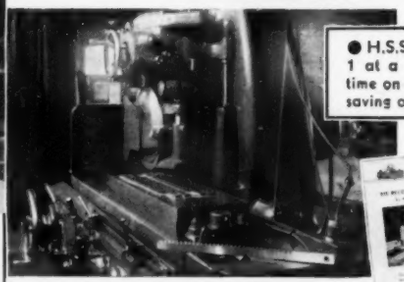
● Caps previously ground few at a time on small grinder. Now, Mattison Grinder handles 75 at a time. Time was reduced from 7 hours to 30 minutes.

● Chuck Plates previously ground 1 at a time — now ground 10 per set-up at a 70% time saving.





● Head Slide Guides formerly ground one at a time in 36 minutes — Now ground on a Mattison Grinder 9 pieces per set-up at a 77% time saving.



● H.S.S. Broaches previously ground 1 at a time — now ground 10 at a time on a Mattison Grinder, at a time saving of 50%.

SET-UP SHEETS

Containing complete information regarding these and similar jobs will be sent upon request.

MATTISON MACHINE WORKS

ROCKFORD • ILLINOIS

Having trouble with hydraulically operated equipment? If it's less smooth, less efficient than it used to be . . . if it requires frequent servicing at too high maintenance cost and too much down-time—then it's time to look into the hydraulic oil.

And after you do, we believe you'll decide to try Houghton's HYDRO-DRIVE "MIH" Series of hydraulic oils. They're fortified for today's tough machining schedules . . . processed to accomplish three aims:

1. To protect moving parts with a tough lubricating film three times stronger than that of ordinary hydraulic oils.
2. To improve greatly the oil's oxidation stability, increasing its resistance to heat, moisture and agitation.
3. To provide unusual solvent ability, preventing deposition of gum and sludge on pumps, valves and working parts.

We have selected the best quality oils, possessing high viscosity index and high demulsibility rating . . . then treated them to attain those three objectives. The result: HYDRO-DRIVE "MIH", which has proved its high performance value in many comparative tests.

Our Technical Staff conducts such tests upon request, taking drainings at regular production intervals to prove stability and long useful life. Write for full details, and for the new booket describing these unusual hydraulic oils.

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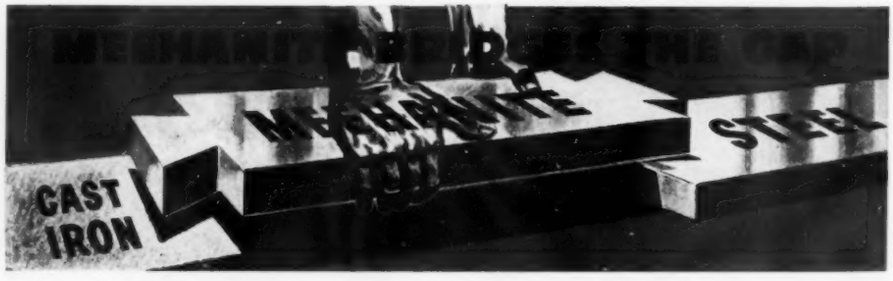
Combining wear resistance with exceptional ability to absorb vibration, MEEHANITE Metal contributes to the long life and smooth operation of York V/W Compressors.

Throughout industry, MEEHANITE Metal solves many problems, improves many products. In its various types, MEEHANITE provides high strength; free machinability; resistance to corrosion, wear, heat; adaptability to heat-treatment and flame-hardening. Design characteristics are reliable and dimensional accuracy is maintained.

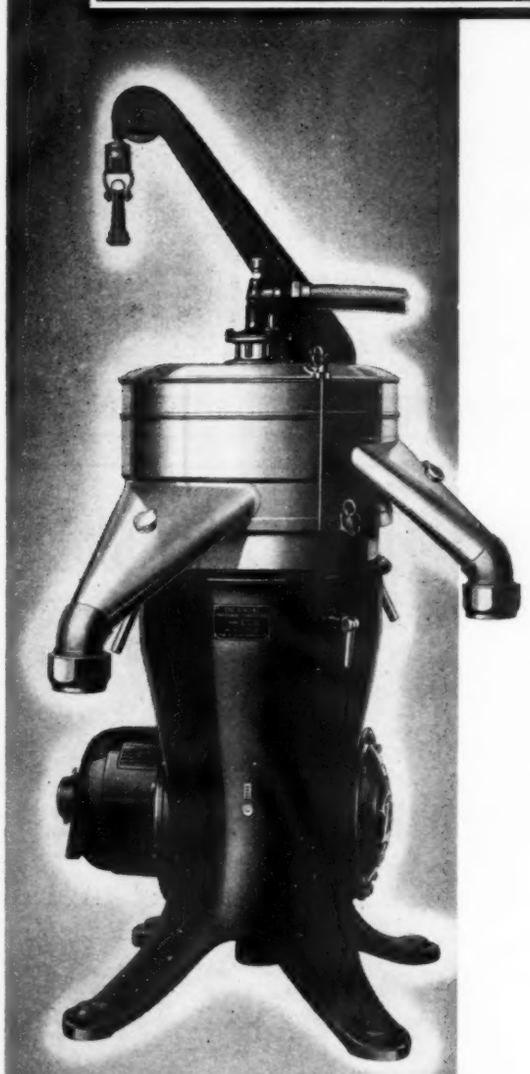
Being a dependable, metallurgically-controlled cast metal having the best features of cast iron and steel, MEEHANITE replaces scarce metals, with complete satisfaction.

For further facts and data, write for Bulletin 13, "MEEHANITE in Industry"

MEEHANITE RESEARCH INSTITUTE, 311 Ross Street, Pittsburgh, Pa.



LESS OIL
now does more and better work



LUBRICATING oil, cutting oil, grinding coolant, flushing oil, hydraulic press oil, honing oil and similar products serve their several purposes efficiently only when they are kept free from the impurities normally collected in service—usually dirt of various kinds, metallic particles and water.

De Laval Oil Purifiers and Coolant Clarifiers remove these impurities so completely that the constantly purified liquid performs at full efficiency over an indefinite period. Oil or coolant is saved; machines are better protected against wear; cutting or grinding tools last longer, can work faster; finishes are improved; parts are protected against damage from rust or grit—all depending upon the specific purpose for which the De Laval machine is installed.

Wherever oil or other valuable liquids are used and can be re-used if cleaned, there is an opportunity not only to conserve material, but often to effect far more important economies and improvements in other directions.

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TO CHEW UP THE AXIS

Perkins Precision, Custom-Cut Gears are helping to power planes, tanks and other tools for victory.

Perkins Gears meet Government specifications in every respect, because this organization has the engineering ability and the equipment necessary to meet the high standards set by the Government.

If you need precision gears in your production or are designing armament which would be improved by the use of precision gears, consult with our engineering staff.

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BEVEL GEARS — RATCHETS
WORM GEARS — SPUR GEARS
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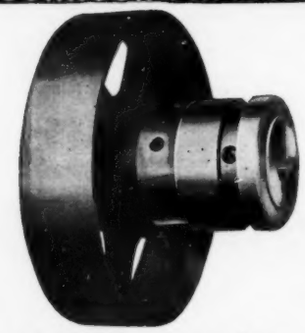
THE JOHNSON FRICTION CLUTCH



Left — Single Clutch with pulley.

Johnson expanding ring type.

Below — Double Maxitorq, Multi-disc Type.

. . for maximum serviceability in minimum space

Has Floating Plates in Neutral

The adaptability of JOHNSON FRICTION CLUTCHES to hundreds of different kinds of machines has been possible by the compactness of these sensitive, durable units.

Many leading manufacturers of industrial machinery have standardized on JOHNSON CLUTCHES because their adoption involved minimum changes in design, and assured a maximum in clutch performance.

In addition to compactness JOHNSON CLUTCHES offer quick smooth starting. They are available for high speed on light powered drives and can be depended on for safety, durability and economy.

Let us show you how easy it is to engineer the JOHNSON CLUTCH into your machines. Just send us details of how you propose to apply the clutch. Ask for our assistance today.

Write for Multi-Disc Clutch Catalog No. 93 or Consult "Sweet's" or "Thomas' Reg."

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

GEAR CUTTING MACHINES

New Design
New Features
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EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

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Westinghouse offers the solution to geared drive problems . . .

If you are faced with a drive problem, look to Westinghouse for the answer.

Westinghouse has the "know-how" that comes from over 50 years' experience in building every kind of geared drive . . . from gearmotors to giant propulsion gears for battleships. Ask your Westinghouse representative for recommendations.

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Westinghouse —— GEARED DRIVES

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SPURS • HELICALS • BEVELS
(Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

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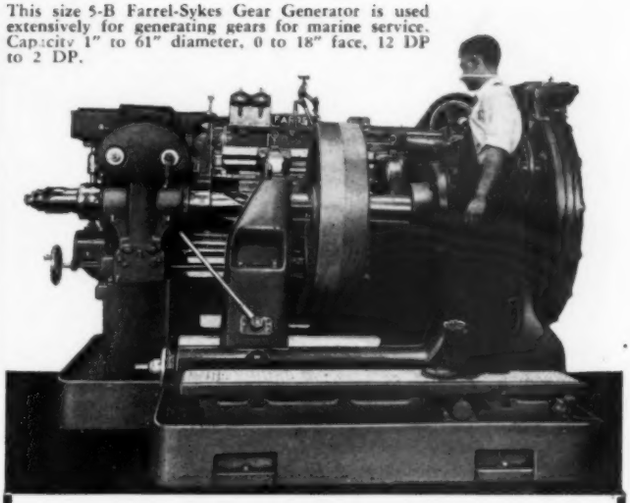
This size 5-B Farrel-Sykes Gear Generator is used extensively for generating gears for marine service. Capacity 1" to 61" diameter, 0 to 18" face, 12 DP to 2 DP.



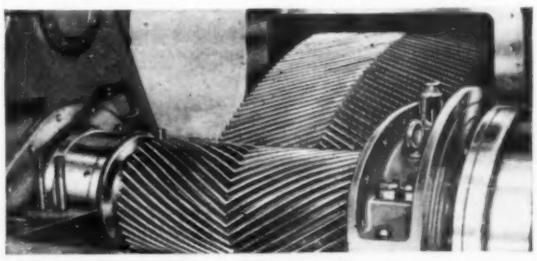
FARREL-SYKES GEAR GENERATORS

Generate Precision Gears for Marine Propulsion Drives

For a variety of U. S. Navy ships, including cruisers, destroyers, corvettes, submarines, mine layers, mine sweepers, and other auxiliaries . . . . for cargo vessels of the U. S. Maritime Commission . . . . for virtually all principal types of commercial vessels . . . . Farrel-Sykes gear generators are being employed extensively for cutting the famous Sykes continuous tooth herringbone gears used in the main propulsion drives.

Whether your specifications call for gears of the smallest practicable minimum or as large as 20-ft. in diameter, Farrel-Sykes gear generators insure uniform tooth contour and accurate tooth spacing. Under all conditions of operation, whether for ship propulsion, heavy duty steel mill operation, high speed pump drives, or precision machine tool service, these Farrel-Sykes continuous tooth herringbone gears provide quiet, dependable operation with the true economy of long-lived, trouble-free performance.

Seven standard sizes of Farrel-Sykes gear generators are available to gear manufacturers for generating gears of all types that operate on parallel axes, in all sizes from 0 to 20 ft. diameter, 0 to 60" face, 24 DP to 0.5 DP. To gear users we offer a complete line of gears and gear units for all purposes, plus experienced counsel and expert assistance on gear problems.



FARREL-BIRMINGHAM COMPANY, INC.
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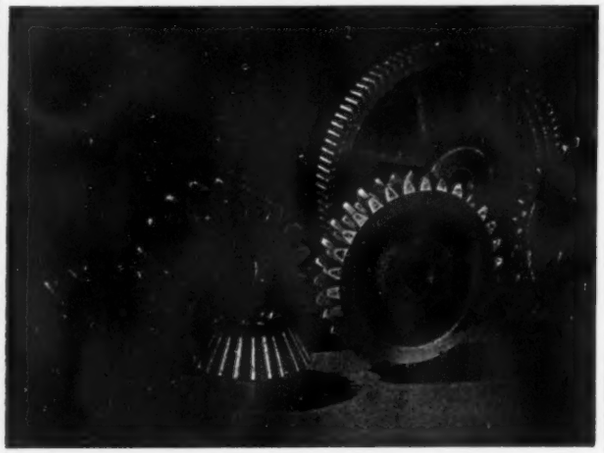

"From the smallest Gear up to 72" diameter.

"Whether your drawings call for standard or special Gears, you will find Grant Gears will give you the high efficiencies and economies that present-day requirements demand."

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Cincinnati Gears are engineered to meet the production requirements of TODAY. Improved Cincinnati Gear techniques, plus modern equipment, are setting new standards of machine performance at many plants.

Forty years of specialized experience in building custom gears, makes Cincinnati Gear Company well fitted to produce "Gears . . . Good Gears Only".

Designed with special tooth form for quiet and efficient operation.

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"Gears . . . Good Gears Only"
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"HARTFORD" for Gears, Cams, Thread-Grinding

OUR SERVICE INCLUDES:

. . . cutting gears of every description exactly to specifications
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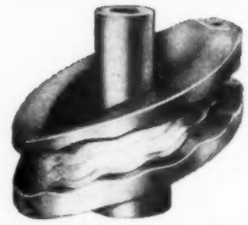
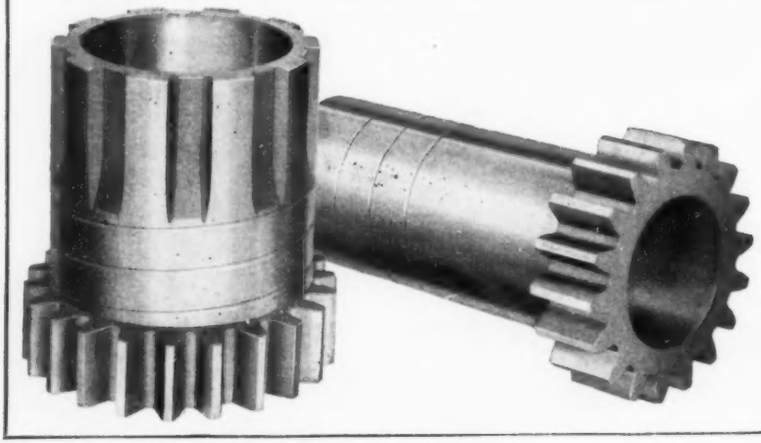
. . . furnishing aeronautical parts on a contract basis

You plan and we execute—assuring speedy production, prompt delivery and reasonable price. Send blue prints or samples for estimate.



THE HARTFORD SPECIAL MACHINERY CO.
HARTFORD, CONN.



ADAMS GEARS

SPUR — HELICAL — WORM
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Splined Shafts A Specialty

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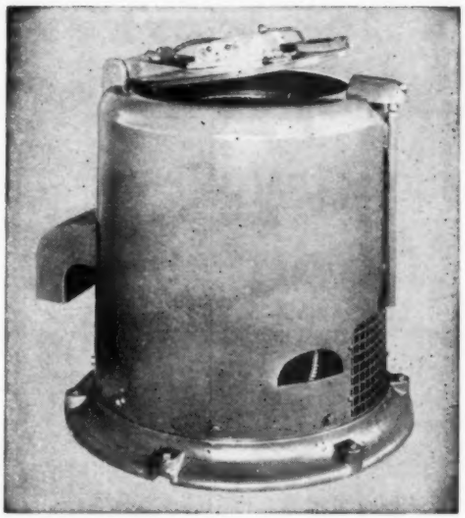
DRY SMALL PARTS QUICKLY and ECONOMICALLY with BARRETT CYCLONE CENTRIFUGAL DRYERS



The Barrett Centrifugal Dryer — efficient, self-contained, and compact is built in several sizes.

• The Barrett Parts Drying Process centers around a method of creating a guarded cyclone.

In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

Direction of basket rotation can be quickly reversed which will change position of the load and accelerate drying. Baskets are available in shapes which experience has shown to be most effective for handling various classes of work.

It will pay to investigate the advantages offered by Barrett Centrifugal Dryers on your work.

Full Details of the Barrett Cyclone Dryer Sent Promptly on Request

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Designers and Builders of Centrifugal Machinery

ALL TYPES
ALL MATERIALS

BILGRAM BEVEL GEARS

Straight — Spiral Teeth

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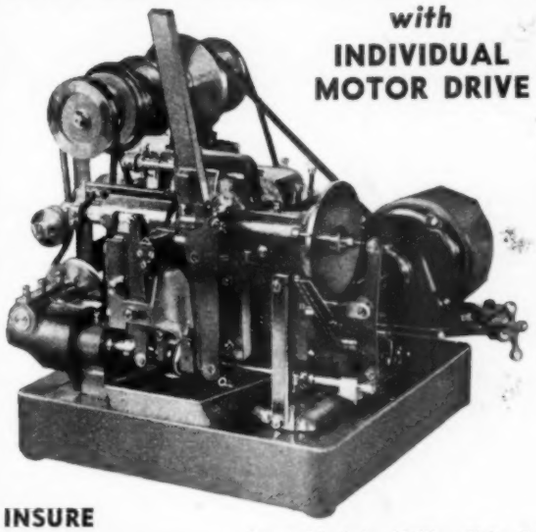
WALTHAM MAGAZINE Fed PINION CUTTERS with INDIVIDUAL MOTOR DRIVE



INSURE
Great Accuracy Smoothness and Production. . . .

Improved in design, Waltham Pinion Cutters achieve not only great accuracy and smoothness of work but also steps up production.

The magazine feed may be omitted and fine pitch gears up to 1½" diameter may be cut in a stack about 1" long.

A countershaft for group drive can be supplied if preferred. Bench space requires 20"x22". Write for further details.

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HIGH STREET **WALTHAM, MASS.**

FINE GEARS of All Types and Sizes

Spur Gears—½ in. to 30 ft. in diameter
Bevel Gears—½ in. to 13 ft. in diameter
Spiral Gears—½ in. to 10 ft. diameter
Worm gears in any practical size

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PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
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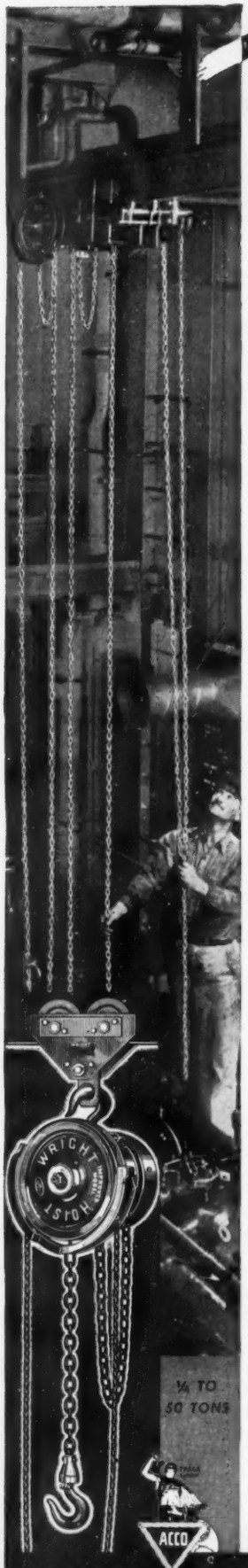

Don't OVERLOAD YOUR HOIST

○ Although **WRIGHT HOIST** are built with load-carrying factors much in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Abuse to machinery, today, is akin to sabotage.

WATCH THE BOTTOM HOOK

• Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, gives visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

WATCH THE LOAD CHAIN

• **WRIGHT HOIST** load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Chains that are excessively overloaded will stretch out of pitch, thus preventing proper fit with precision load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well-lubricated for long life.

Victory demands all out efficiency in production. Victory demands speed. Victory demands steel. Abuse of machinery wastes all three. Take proper care of your **WRIGHT HOIST** so that it lasts. You can find the name of your nearest Wright distributor in the telephone book.

WRIGHT MANUFACTURING DIVISION
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Abrasive dust and grit permitted to *circulate at large, wherever men and machines are at work, will cause untold damage both to machines and to health of employees.*

TORIT Self-contained DUST COLLECTORS attached to grinding, buffing and cut-off machines will efficiently and economically trap this dust hazard. TORITS are portable—may be placed wherever needed.

Write for bulletin giving the TORIT features, specifications, and prices. We will gladly help you solve your dust control problem.

Traps dust from grinding and buffing wheels instantly!

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TORIT Dust Collectors
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Changes sludge to sparkling liquid

Sparkler horizontal plate filters have many exclusive advantages that make them simple and quick to prepare, clean and operate. The modern, straight down filtering process through nested interchangeable plates may be helped by either air or gas pressure, or by vacuum, using any filtering powder or other aids.

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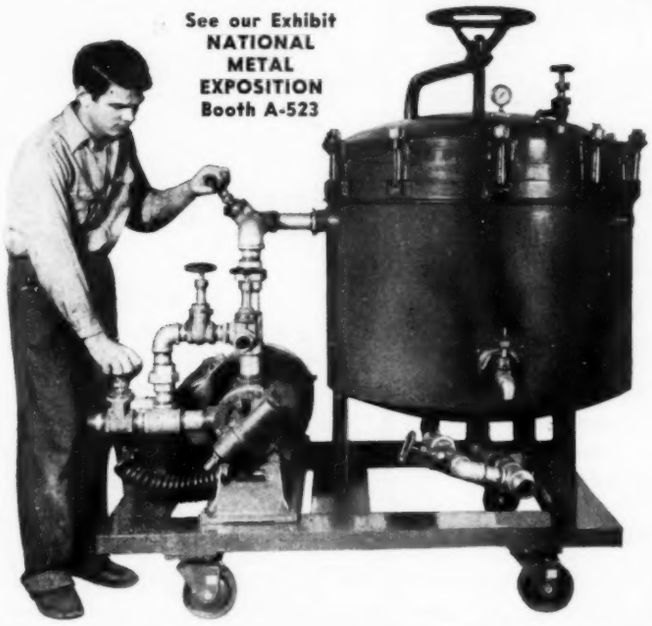

for cutting oils

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grinding oils

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honing oils

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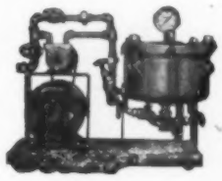

This small, inexpensive laboratory filter will pre-determine results from filtering operations on production filters.

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SPARKLER HORIZONTAL PLATE FILTERS

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- ☐ Cold Immersion Cleaning
- ☐ Cold Spray Cleaning
- ☐ Floor Maintenance
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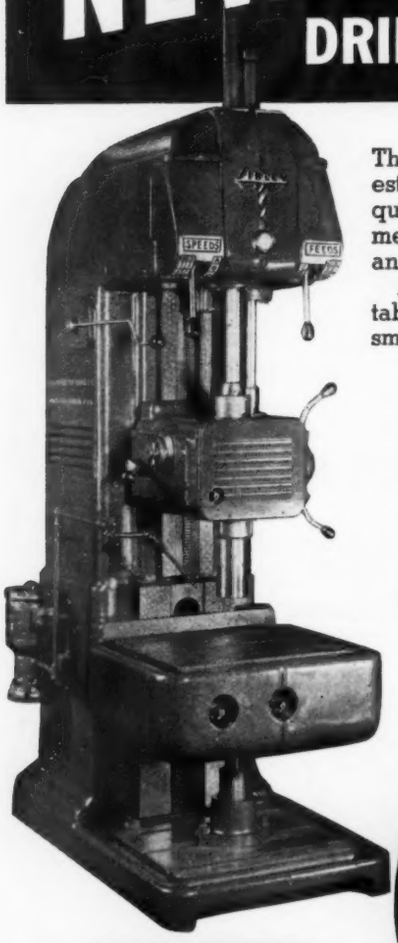

This new Sibley will handle the toughest jobs you've got—and do them quicker and at lower cost. It has tremendous power, extreme accuracy and maximum operating convenience.

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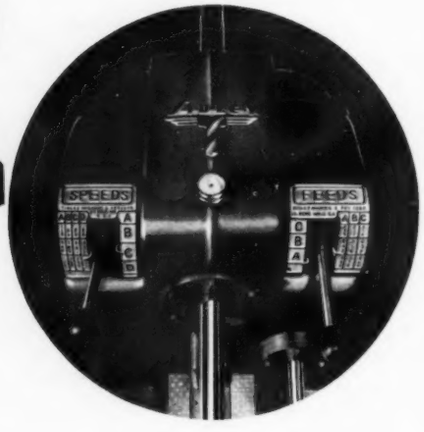

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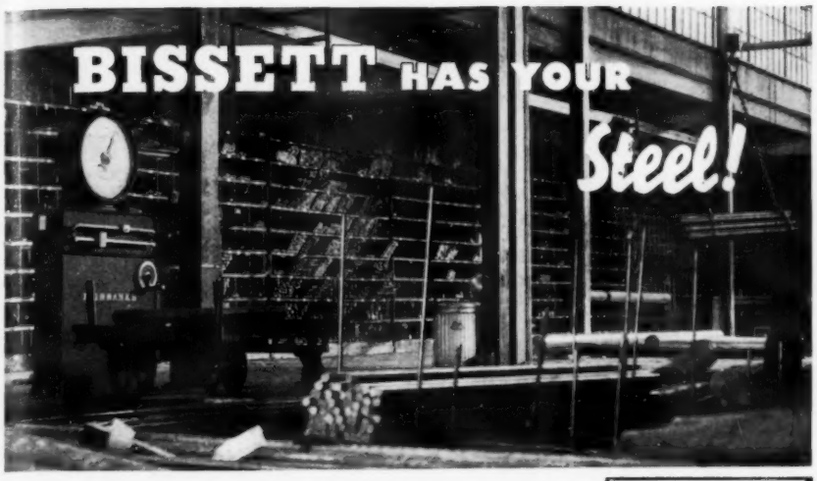

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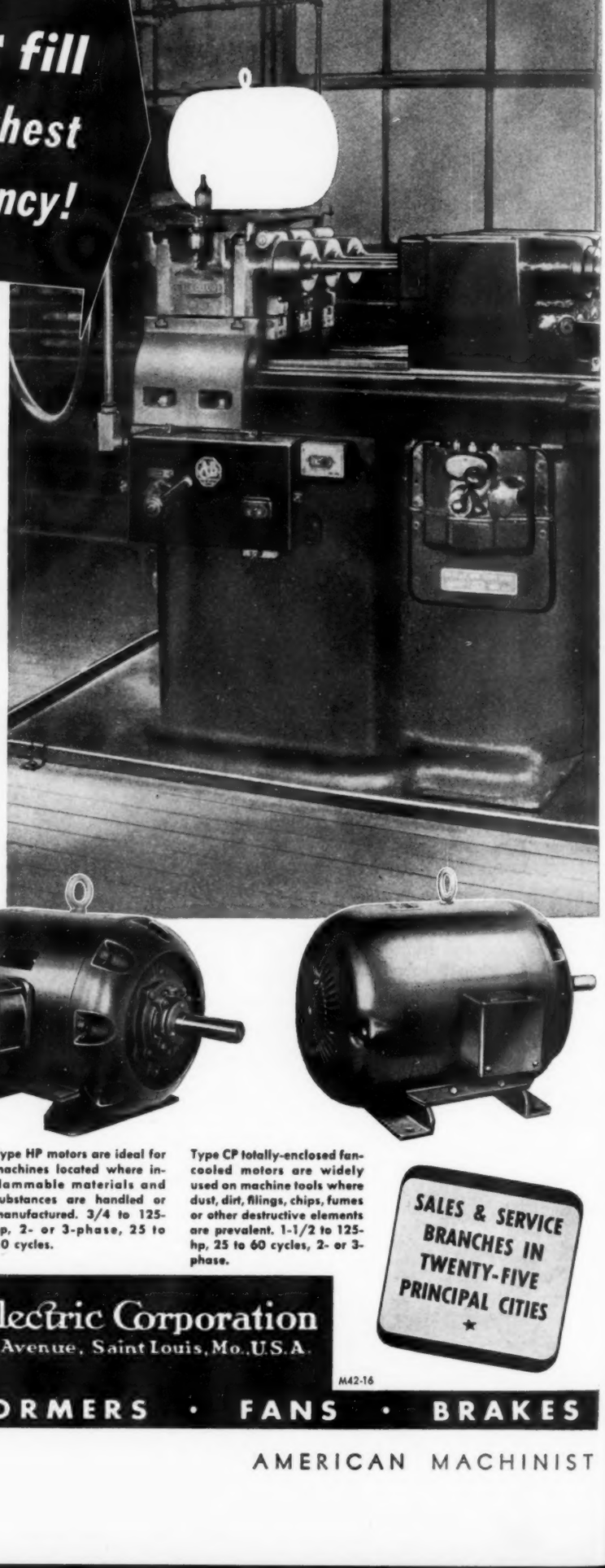

Machine tool efficiency is of vital importance in the present speed-up of production. Motor failure with attendant delay and expensive "out-time" cannot be tolerated in this national emergency.

Your best protection against production delay and unnecessary expense is to use Wagner Motors on all machine tools and other electrically driven equipment. Their long life and absolute dependability make them well-suited for the job.

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Type RP Squirrel-Cage motors are used on machine tools and other electrically driven equipment that operate in clean, dry locations. 1/6 to 400-hp, 25 to 60 cycles, 2- or 3-phase.

Type HP motors are ideal for machines located where inflammable materials and substances are handled or manufactured. 3/4 to 125-hp, 2- or 3-phase, 25 to 60 cycles.

Type CP totally-enclosed fan-cooled motors are widely used on machine tools where dust, dirt, filings, chips, fumes or other destructive elements are prevalent. 1-1/2 to 125-hp, 25 to 60 cycles, 2- or 3-phase.

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BULLETINS MU-182 and MU-183

Wagner Electric Corporation
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M42-16

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In a great many plants Ingersoll D-B-L Steel has made warm friends of those who buy and use Hack Saw Blades . . . In some cases only the necessary conservation of vital alloys gave D-B-L a reluctant first trial . . . Today in these same shops D-B-L is enthusiastically accepted and approved because it is so high in impact resistance, provides so tough a cutting edge, and is so relatively free from decarburization.

These advantages, plus *lower cost*, have won for Ingersoll D-B-L Hack Saw Steel a permanent place along with Ingersoll 18-4-1 and Molybdenum which were pre-war favorites.

Specify Ingersoll D-B-L Steel on orders for Hack Saw Blades

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INGERSOLL SPECIAL STEELS for SPECIAL USES

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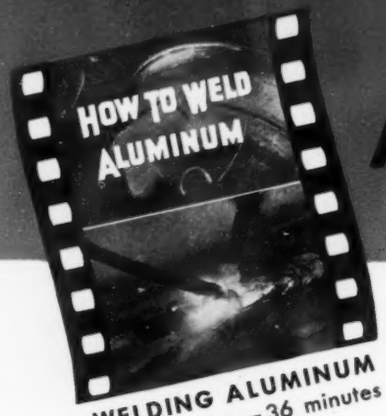
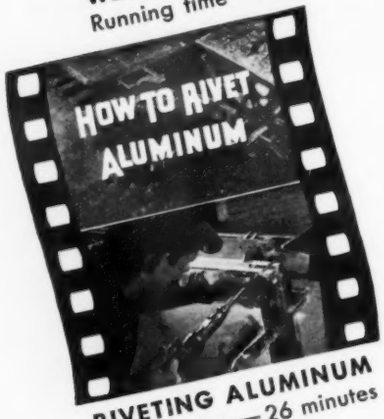


WELDING ALUMINUM
Running time—36 minutes



RIVETING ALUMINUM
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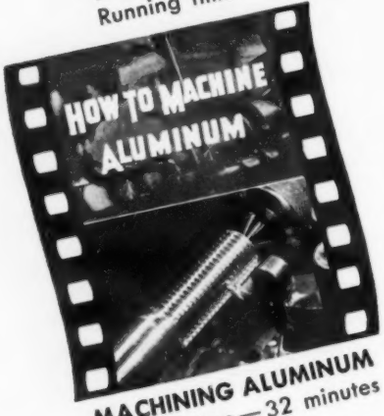

MACHINING ALUMINUM
Running time—32 minutes

Valuable "how-to-do-it" data on Welding, Riveting and Machining Aluminum is contained in these three, brand-new sound motion pictures. Designed to supplement texts and teaching, these films are offered for your assistance in training war workers in the fabrication and assembly of Aluminum Alloy parts and structures.

No drama, no humor, no romance! Every foot of these films is packed with hard-hitting task instruction.

"How To Weld Aluminum" describes and demonstrates the various essentials of torch and arc welding, brazing and resistance welding. "How To Rivet Aluminum" portrays the making and testing of rivets, preparation of the work, actual rivet-driving techniques and inspection. "How To Machine Aluminum" discusses alloys usually used, the kind and shapes of tools, cutting compounds, speeds and feeds.

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Prints of these black and white, sound motion pictures are loaned free.

List the titles of the pictures you want . . . your first and second choice of dates when you want them . . . whether you want 35 mm. or 16 mm. prints . . . and the approximate number of days you expect to use them. (NOTE: These films can be shown *only on sound projectors.*)

If you want to purchase prints for your permanent library, they are available at cost, shipping charges prepaid. Prices follow.

	16 mm. with fibre container	35 mm. with metal container
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How To Weld Aluminum	1600-ft. reel . . 62.70	2000-ft. reels . . 176.30
How To Machine Aluminum	1200-ft. reel . . 50.70	2000-ft. reels . . 123.55

Send your requests for loan or purchase to Aluminum Company of America, 2107 Gulf Building, Pittsburgh, Pennsylvania.

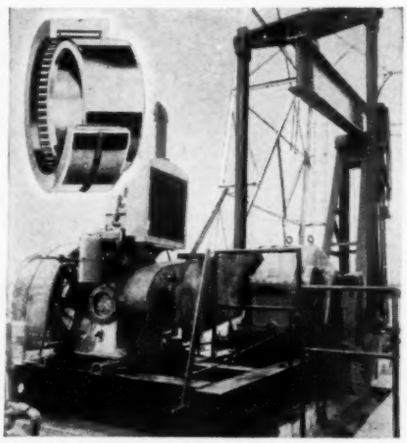
See these films at the National Metal Exposition, Cleveland, October 12-16.

ALCOA ALUMINUM

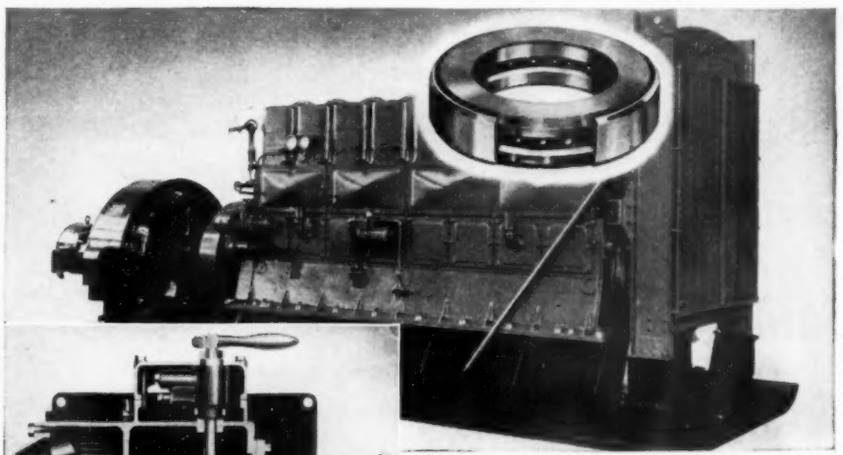
IN THE NEWS
WITH BANTAM BEARINGS

GIANT ENGINES KEEP THEM FLYING, furnishing smooth, unfailing power for America's fast-expanding air fleets. Many of the nation's speediest, most efficient bombers, fighters, transports, and cargo planes are powered by huge, air-cooled, radial engines that develop 2,000 horsepower. Among the many engineering features that contribute to the successful performance of these engines is the use of Bantam Needle Rollers to provide anti-friction bearing units of unusually light weight and small size in proportion to their load capacity.

WELL DRILLING SPEEDS ARE FASTER, loads are heavier, depths are greater. 8-inch Oil-bath Rotary Swivels built by The International Derrick and Equipment Company embody in their design every feature and strength factor necessary in present-day drilling practice. Bantam Bearings provide a safe load capacity far above the most rigid requirements of the service, are a vital factor in the high performance standards of the equipment.



BACKBONE OF A COMBUSTION ENGINE is the crankshaft construction—and Weber Engine Company, after exhaustive studies, selected Bantam Quill Bearings for use on this vital part of their Vertical Gas Engines. Bantam Quill Bearings combine the advantages of anti-friction construction, high load capacity, small size, and ease of installation. For full details on this unusual bearing, write for Bulletin D-104.



IN GENERATING PLANT OR EXCAVATING MACHINERY, Diesel power is increasingly important. Built by Atlas Imperial Diesel Engine Co., giant units of the type shown are performing reliably and efficiently. To assure accurate speed control, Atlas utilizes Bantam Ball Thrust Bearings in the governor assemblies shown in the cut-away view.

BANTAM'S ENGINEERING COOPERATION is especially valuable in meeting new and unusual requirements. Bantam makes every major type of anti-friction bearing—straight roller, tapered roller, needle, and ball. Bantam engineers aid in the selection of the type that best suits your application—or design special bearings that meet your requirements. If you have a difficult bearing problem, TURN TO BANTAM.

BANTAM BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

Fitting the dozens of cores for Magnesium airplane castings in molds like this one calls for exacting workmanship. We like to feel that the accuracy employed in American Magnesium Corporation foundries, the skill and dexterity of our workers, aid the gunner's aim when these planes get into action.

Mazlo workers are continuing their all-out effort to produce the tremendous quantities of Magnesium Alloy products needed for the war effort. As you know, airplanes and other combat equipment are taking every pound of these lightest of lightweight metal products we can produce. But tomorrow, when this war is won, there's going to be plenty of Magnesium for every peacetime use.

In thinking of the future, are your designers aware of what the high strength-weight ratio of Magnesium can do for your products? Mazlo engineers are available to assist you on tomorrow's problems as well as today's. Sales Agent for Mazlo Magnesium Products: Aluminum Company of America, 1709 Gulf Building, Pittsburgh, Pennsylvania.

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For 26 years, Lovejoy has been noted for prompt, efficient service. Even now, with the rush of war orders, you can expect Lovejoy to rush new Positive-Locking Milling Cutters to you with the least possible delay. We are working 7 days a week to give the service you have always expected. Special tools may take a bit longer, but we will be pleased to give you a promise that will be held.

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The famous Lovejoy Positive-Locking Blades will do double duty for you because they are interchangeable over a wide range of cutter sizes. Lovejoy users appreciate this feature — especially in the pinches! If you do have a few days, however, Lovejoy can supply you out of stock with all standard blades. But be sure to use your present blades to the limit (over ½ their length) before ordering new ones, thus conserving scarce material. High Speed Steel, Cemented-Carbide, Stellite, and Rexalloy blades are stocked for immediate shipment.

Please send me the 24-page Lovejoy catalog covering the full line of Lovejoy Milling Cutters and Blades.

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MACHINE TOOL BEARINGS

● Bunting Bronze Bearings have always been an indispensable part of machine tool development. Today these bearings serve in countless machine tools that are winning the war on the industrial front.

The precision standards of machine tool operation today demand bearings that support spindles and other moving parts with constant, unvariable accuracy. In this vital function nothing can take the place of the bronze sleeve-type bearing.

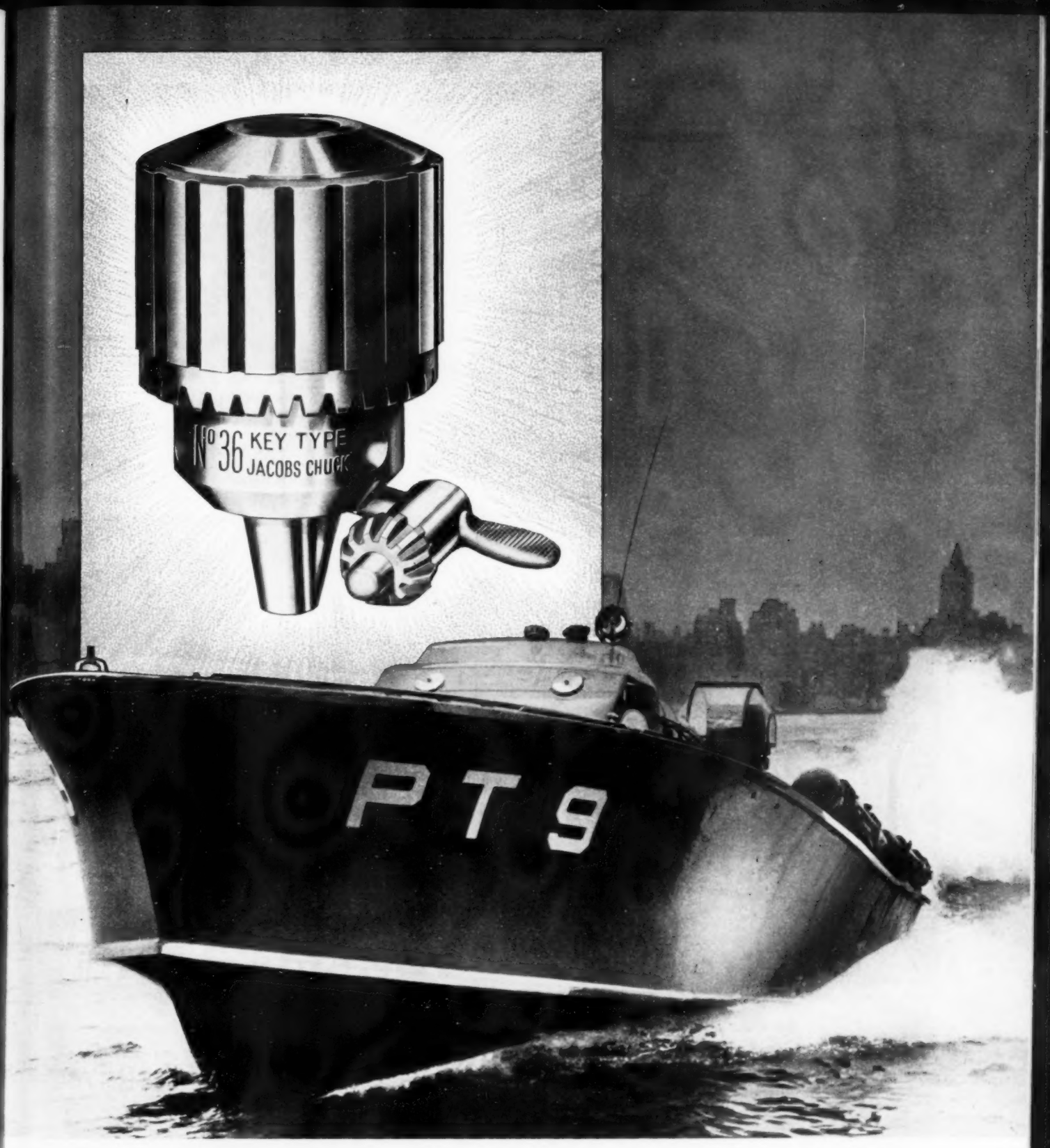
Let Bunting's vast experience in this field serve you today in the equipment and maintenance of the machine tools so urgently needed in the all-out war effort. The Bunting Brass & Bronze Company, Toledo, O. Warehouses in All Principal Cities.

WINNING THE WAR WITH MACHINE TOOLS

The machine tool is the outstanding factor in the production of war material. The fact that the machine tool industry of America is winning a gigantic battle with the machine tool builders of enemy nations is today the most significant indication of ultimate victory for the United Nations.

Bunting

BRONZE BUSHINGS • BEARINGS • PRECISION BRONZE BARS



DESIGN FOR VICTORY

Unfailing performances of all JACOBS CHUCKS assure the maintenance of speedy metal working operations. Complete confidence in these fine tools is justified by exclusive Jacobs designs for more strength, closer accuracies, better gripping powers, longer wearing qualities. Their application to America's production efforts means speed . . . and speed means Victory! The Jacobs Manufacturing Co., Hartford, Conn.

IF IT'S A JACOBS ★ ★ ★ — IT HOLDS!

Parker-Kalon Type "U" Hardened Metallic Drive Screws eliminate tapping operations in the assembly of Aircraft Bomb Fuses. Automatically fed and driven, these Screws save hours of assembly time.

Saving Operations ON IMPORTANT WAR ASSEMBLIES... WITH THE RIGHT TYPE OF P-K SELF-TAPPING SCREW!

No matter what you're producing for the fighting forces – bomb fuses, field kitchens, gun sights, radio transmitters, machine guns or range-finders – there's a type of Parker-Kalon Self-tapping Screw that will help you *save operations* and cut *assembly time!* No matter what material you're working with – plastics, die castings, sheet steel, aluminum, bronze or brass – Parker-Kalon Self-tapping Screws will give you stronger fastenings, *while eliminating costly, time-consuming tapping operations.* You'll gain valuable time, too, when you cut out the fumbling that goes with using bolts and nuts – when you put P-K Screws on the job instead of trying to rivet in hard-to-get-at-places!

Parker-Kalon's rigid control over screw quality is another time-saver to war-busy industries. Every Parker-Kalon Self-tapping Screw is guaranteed to drive easily and hold tight! "Doubtful screws" – screws that *look all right* but fail to *work right* have been eliminated by the Parker-Kalon Laboratory's thorough check-up routine.

Call in a Parker-Kalon Assembly Engineer to study your fastening problems – chances are that he can quickly help you find ways to speed up your assemblies with the proper use of Parker-Kalon Self-tapping Screws. Parker-Kalon Corporation, 194-196 Varick Street, New York, N. Y.

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Give the Green Light to War Assemblies

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—the misleading measure of production

It requires but one eye to see that man-hours alone are no measure of production. The thing that counts is how much that man can produce in one hour.

ALTER EGO: Sure. By one method he may produce two or three times as much per hour as by another method.

Take arc welding. This method results in far greater effectiveness. In joining steel, one welder does the work of two, three or four men using other methods. And he does a better job with 15% to 25% less steel.

ALTER EGO: Then it would seem a better measure for a company's contribution to the war effort would be METHOD-HOURS.

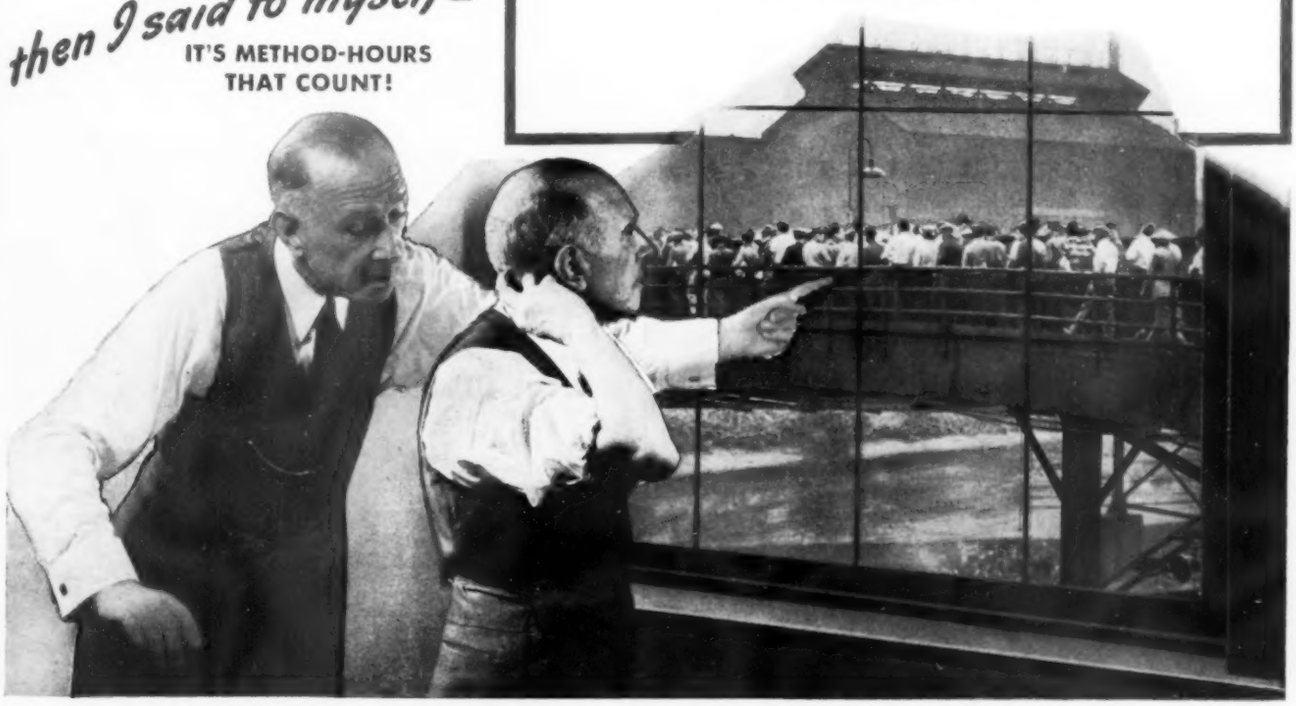
True as gospel. Our whole war production has been zoomed by those who grabbed arc welding as the only way to save our national neck.

ALTER EGO: And later they'll be schooled in an art to save their individual necks when competitive production again seeks profitable markets.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

ALTER EGO: Literally, "one's other self"—the still, small voice that questions, inspires and corrects our conscious action.

then I said to myself—
IT'S METHOD-HOURS THAT COUNT!



PROMOTED

on merit

32 YEARS' DISTINGUISHED SERVICE

One advancement after another — covering more than three decades — has built up Allen's capacity for this emergency. Plant equipment and product-improvement have "worked their way up" to the top.

Training *started in 1910* has qualified this organization to maintain manufacturing standards under war pressure. Quality has not been demoted in the all-out production-drive.

On their RECORD in the hollow screw field, "Allens" have been promoted to First-in-Demand. Their rank is recognized as the earned reward for Distinguished Service.

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

Speed Production with... WEATHERHEAD FITTINGS AND HOSE

WEATHERHEAD products speed production in *two* ways:—first, by ease and reduced time of installation through elimination of needless operations; second, because they are engineered not only for performance but also for mass production to provide the increasing output so essential today.

ERMETO SAFETY FITTINGS—Ermeto speeds production by eliminating flaring, threading, welding, or soldering. Provides leak-proof connections on tubes of any metal. Withstands high pressures and excessive vibration. *Holds up beyond the burst strength of the tube itself.* Easily connected or disconnected.

BRASS TUBE FITTINGS—Complete line of tube service parts and fittings for every purpose. Inverted, S. A. E., and compression types with square finish to simplify installation.

FLEXIBLE HOSE ASSEMBLIES—Non-metallic flexible hose for automotive, aviation and machine uses. Oil-proof—gasoline-proof, Weatherhead complete hose assemblies with fittings attached answer the need where high pressures are involved.

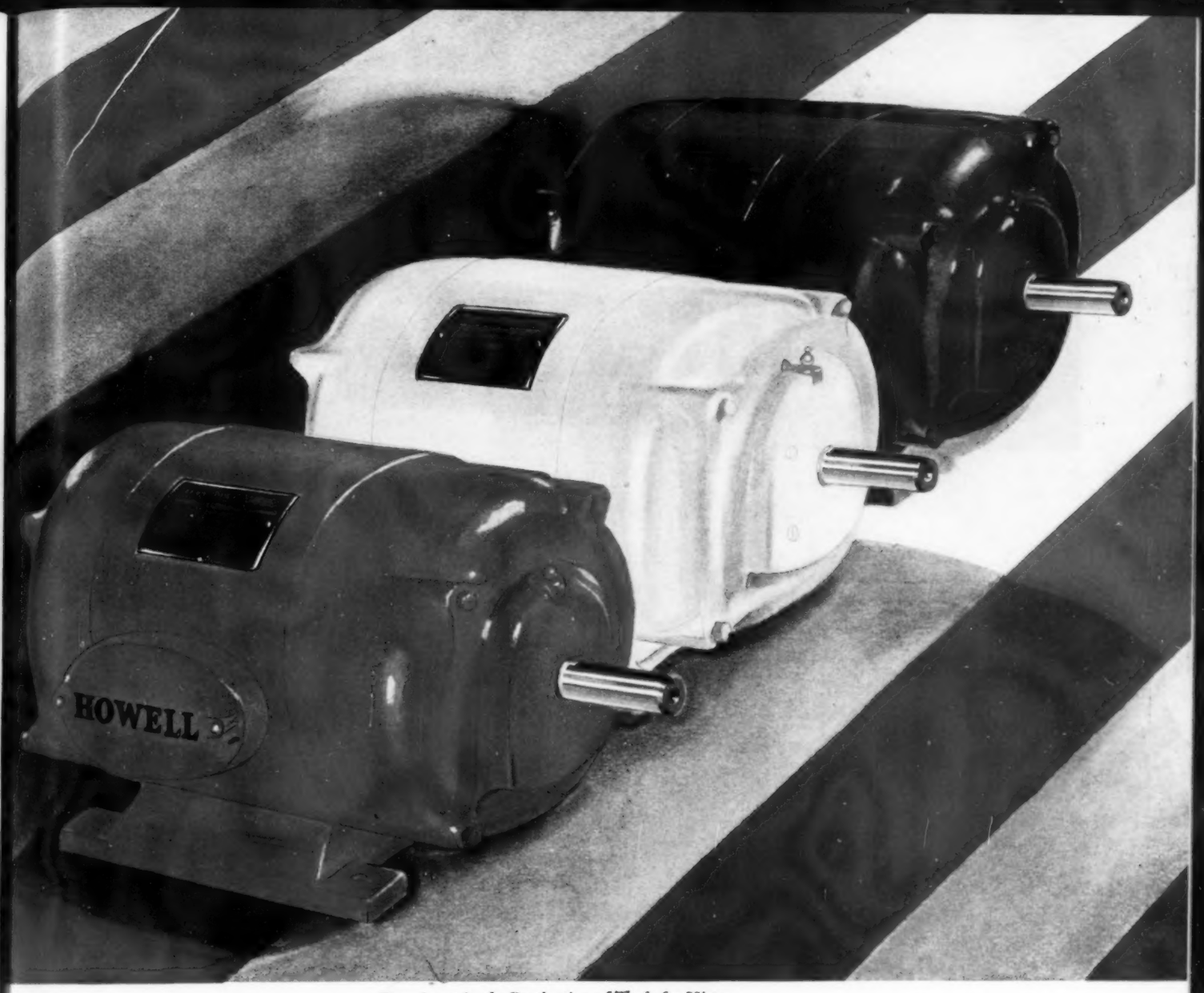
Weatherhead also provides low pressure hose in any length with necessary fittings.

PACKLESS VALVES—Advanced design, positive and dependable; simple, with a minimum of working parts; leak-proof, quick-acting, sturdy. Low overall height; natural grip hand-wheel; full capacity openings; ideal for fuel lines.

Tell us the Weatherhead products in which you are interested and we'll send complete details.

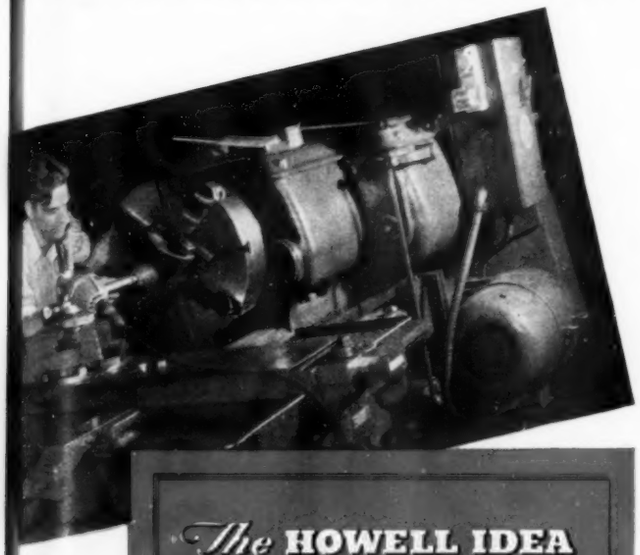
THE WEATHERHEAD CO., CLEVELAND, OHIO

WEATHERHEAD
TUBE FITTINGS • FLEXIBLE HOSE • VALVES • DRAIN COCKS
AVIATION, AUTOMOTIVE AND REFRIGERATION SPECIALTIES



Prominent in the Production of Tools for Victory.

Howell Motors CAN TAKE IT!



The HOWELL IDEA in Electric Motors *precision-built*

Let's hit the nail on the head. This is an emergency. Time is short! You can't afford motor delays, repairs, unnecessary overhauls. Building a better motor, putting more quality into every part, working to closer limits of precision all through —insures greater dependability, fewer breakdowns, freedom from delays, quieter operation. That is the Howell Idea in Electric Motors. That's why Howell Electric Motors make fast friends as soon as they get on a job. That's why more and more vital war plants are ordering and reordering Howells, for their important jobs. That's why we're busy — working exclusively on top priorities for essential war industries. Call in a Howell Representative . . . let him tell you why engineers and mechanics, men who know motors best, say "Howell Motors CAN TAKE IT!"

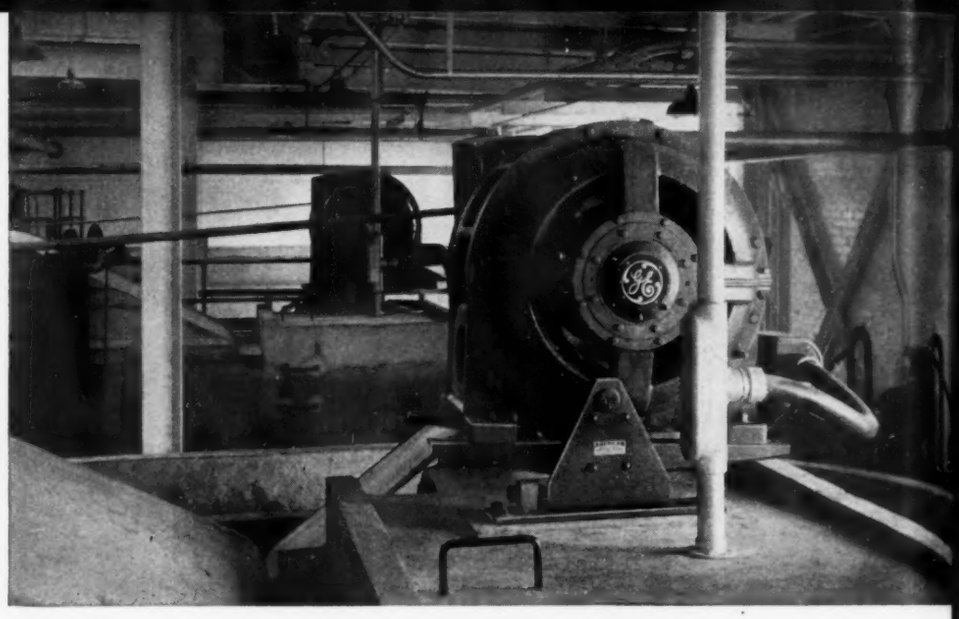
HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

MANUFACTURERS OF ELECTRIC MOTORS SINCE 1915

Conservation Demands:—Save Belts,

AMERICAN



***ECON-O-MATIC DRIVES** are **American Short-Center Drives**, either flat-belt or V-belt, with **American Econ-O-Matic Motor Bases** for automatic tension control . . . and thus automatic economy . . . in materials, maintenance man-hours and electric power.

With 44 American Econ-O-Matic Flat-Belt Drives Ecusta Paper Corporation's Beaters Have Operated Several Years Without a Letdown!

Washer breaker beaters in a paper mill have a tough job. They have to beat pulp into the consistency required by paper machines. Beater drives have to withstand heavy starting loads and occasional "shock" loads as more pulp is added. Four years ago, Ecusta Paper Corporation, Pisgah Forest, North Carolina, decided to install short-center belt drives to operate 44 washer breaker beaters.

American Pulley engineers recommended that Ecusta install **American Econ-O-Matic Flat-Belt Drives** to operate these beaters. Equipment installed included 44 of each of the following:

D-15 **American Econ-O-Matic Motor Bases**
18" x 21" **Hi-Torque Motor Pulleys** (driving pulleys)
96" driven pulleys
20" wide endless flat belts on 110" centers
125 HP motors, operating at 514 RPM

RESULTS: Beaters have operated for several years without a letdown. Belt slippage is at a minimum. Belt tension control is excellent, despite wide variations in load. Belt life is exceptionally long. Service is severe, but **American Econ-O-Matic Drives** have kept maintenance costs so low that the Ecusta Paper Corporation is completely satisfied.

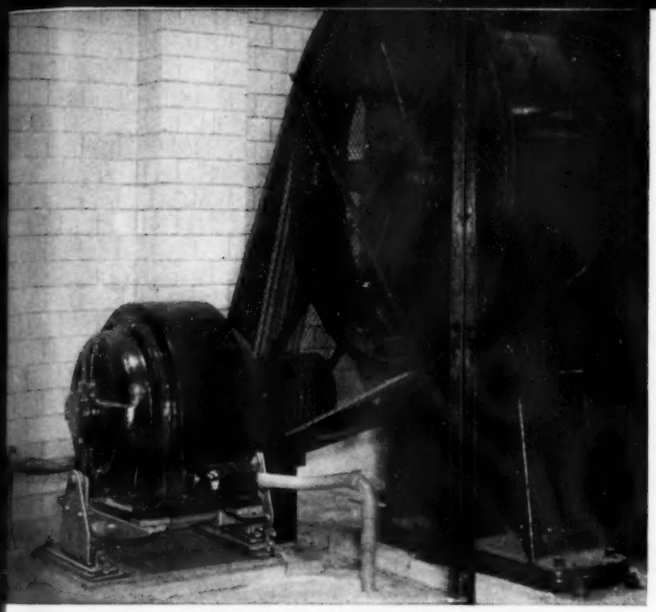
American Econ-O-Matic Drives give this excellent service because they are the most efficient available, according to tests by engineers for leading belting manufacturers. Write today for more information—how to specify short-center power transmission drives, flat-belt or V-belt, for the new machines you're building or buying! There's an **Econ-O-Matic Drive** available to fit your purpose and save production costs!

The American

4275 WISSAHICKON AVENUE

Power, Bearings...and Man-Hours with

Econ-O-Matic* DRIVES



AMERICAN Drive Selection Service

CONSERVATION IS VITAL!

Rubber, duck fabric, leather and other materials from which belts are made are now relatively scarce. Belts must last longer. Because of varying loads on belting, automatic tension control is necessary . . . for longest belt life. **American Econ-O-Matic Drives**, either flat-belt or V-belt, assure these conservation advantages:

1. Belt life increased by an average of 100%.
2. Bearing pressure reduced by an average of 50%.
3. Maintenance costs cut as much as 75%.
4. Power savings often pay the initial cost of **American Econ-O-Matic Drives** within the first year!

8 American Econ-O-Matic Bases Make V-Belts Last Longer in George Washington Bridge Entrance Tunnel!

In the West 178th Street Entrance Tunnel Ventilating Building, at one approach to the George Washington Bridge, there are eight blowers—huge air-conditioning fans that keep air circulating as motorists drive toward the great bridge.

Each blower is driven by a three-speed motor rated at 50 HP at 900 RPM, 15 HP at 600 RPM, and 2.5 HP at 300 RPM. Center distance on the drives is 4'8". They were installed early in 1938.

All eight motors are mounted on **American Econ-O-Matic Motor Bases,** which assure automatic tension control and thus at least 100% longer belt life. Motor, shaft and fan bearings also last longer . . . with no replacements necessary in four years of service!

Power savings and lower maintenance expense, both in man-hours and materials, are other advantages of these eight drives. Performance has made these **Econ-O-Matic Motor Bases** an excellent investment—they've paid for themselves in savings!

★ ★ ★

Ask your "American" Distributor to show you the new ECON-O-MATIC DESK PRESENTATION. It shows clearly how the principle of automatic tension control works . . . and how **American Econ-O-Matic Drives** speed production, increase belt life, reduce bearing pressure, cut power bills and save an average of 75% in maintenance expense.

Pulley Company

PHILADELPHIA, PA.

A flexible machine that is the last word in simplicity of operation

HI-SPEED HONING and LAPPING MACHINE

for use with any standard make honing head

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

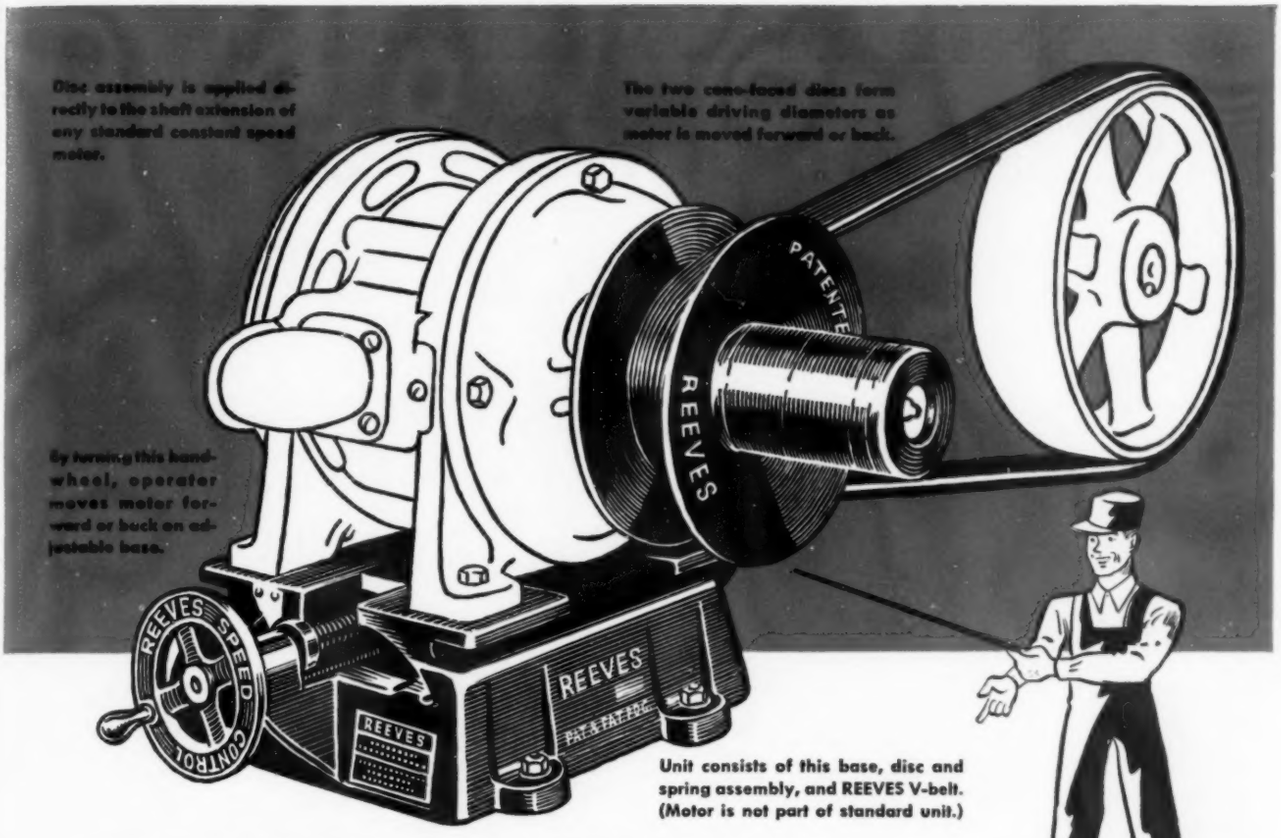
Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) . . Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) . . Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2¾"	2¾"	2¾"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44" x 60"	60" x 80"	60" x 80"	60" x 108"
Overall Height	11'6"	15'3"	18'3"	23'8"

NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

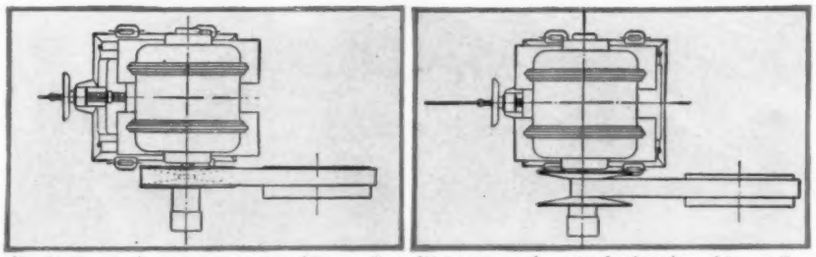

Disc assembly is applied directly to the shaft extension of any standard constant speed motor.
The two cone-faced discs form variable driving diameters as motor is moved forward or back.
By turning this handwheel, operator moves motor forward or back on adjustable base.
REEVES
REEVES SPEED CONTROL
REEVES
REEVES
PAT. & PAT. PEND.

Unit consists of this base, disc and spring assembly, and REEVES V-belt. (Motor is not part of standard unit.)

REEVES VARI-SPEED MOTOR PULLEY

Two cone-faced discs are mounted on the standard motor shaft extension. Motor is mounted on adjustable base. Through handwheel control, motor is moved forward or back, varying depth of throat between discs. A REEVES V-belt, running between discs and connected to driven machinery, is kept under constant tension by a compression spring. As depth of throat is varied, V-belt assumes different diameters of contact against discs. Speed adjustments are infinite between the limits, and are made while equipment is running. Constant torque; variable horsepower.

REEVES OPERATING PRINCIPLE THAT GIVES PRODUCTION MACHINES "FIGHTING SPEEDS"



Maximum speed—motor nearest to driven pulley Minimum speed—motor farthest from driven pulley

THESE VITAL ADVANTAGES for War Production

FULL-RANGE SPEED ADJUSTABILITY: Not just steps in speed, but any speed—to meet changes in size, shape, periphery or type of work.

NO WASTE IN TIME OR MATERIALS: Speed can be adjusted to skill of workers, to prevent waste and spoilage. Speed changes made without stopping driven machine. Valuable aid to new workers.

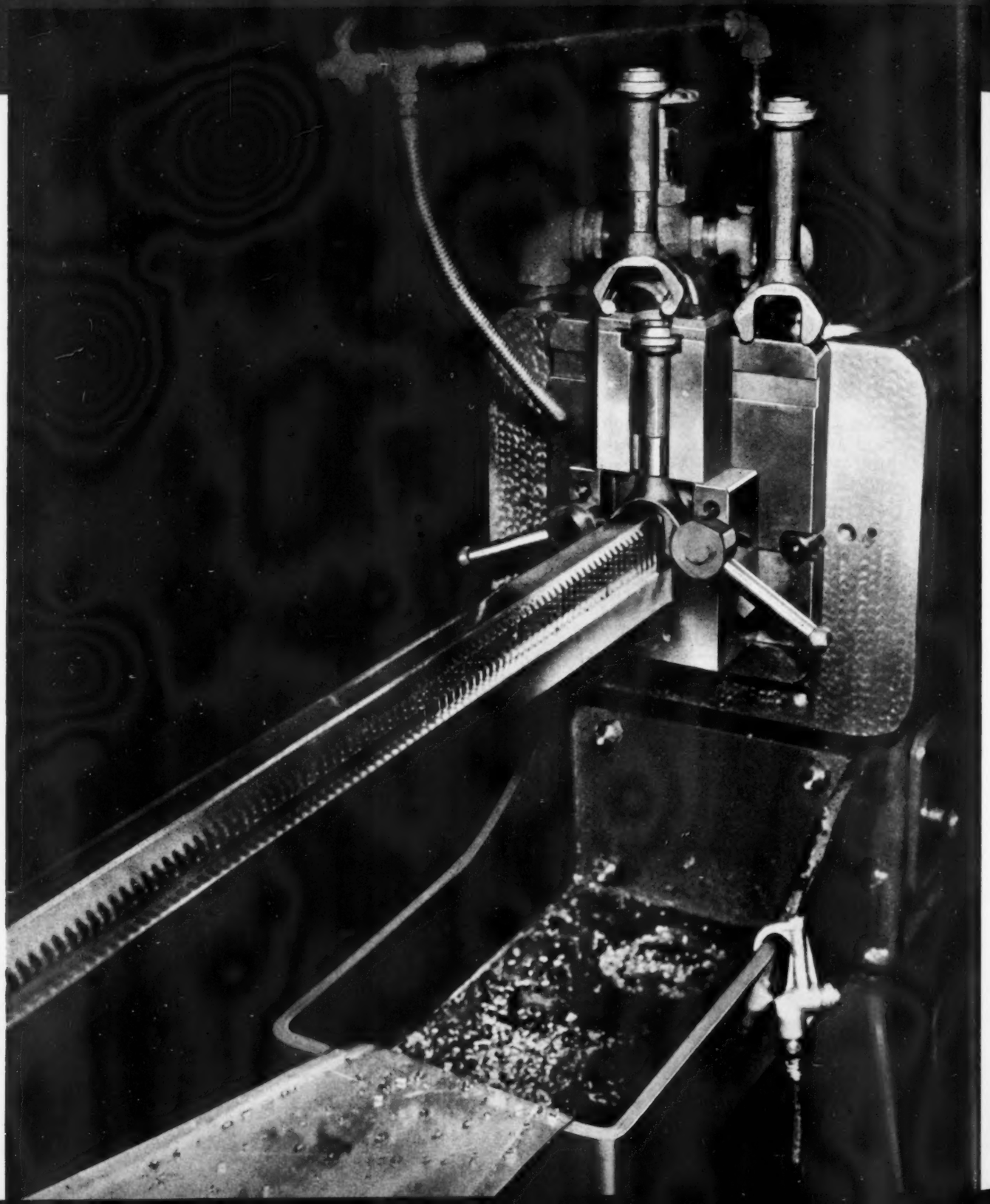
OPERATING PRINCIPLE PROVED in 210,000 installations, including use as standard equipment on 1,440 different makes of machines.

NATION-WIDE ENGINEERING SERVICE: REEVES engineers in 36 leading industrial centers will help you choose the proper unit and apply it correctly.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES *Accurate Variable* Speed Control

LAPOINTE BROACHING SPEEDS
MASS PRODUCTION OF VITA-
PARTS FOR FLYING FORTRESSES



Boeing Flying Fortresses—the planes that are proving their deadliness so spectacularly by successful operations in the southwest Pacific and other war areas—are now being built by quantity production methods. One of the many high speed operations in the Boeing plant is that of broaching the jaws of steel forgings, using the three broaches shown above and the Lapointe Horizontal Hydraulic Broaching Machine shown at the right.

Aircraft engine manufacturers, builders of bombers and pursuit planes, manufacturers of ordnance of all types are turning to Lapointe broaching to speed up precision operations on the intricate contours of many vital parts. There are Lapointe Broaching Machines to handle parts of all sizes, from small pistol barrels to anti-aircraft gun breech blocks weighing over 1000 pounds.

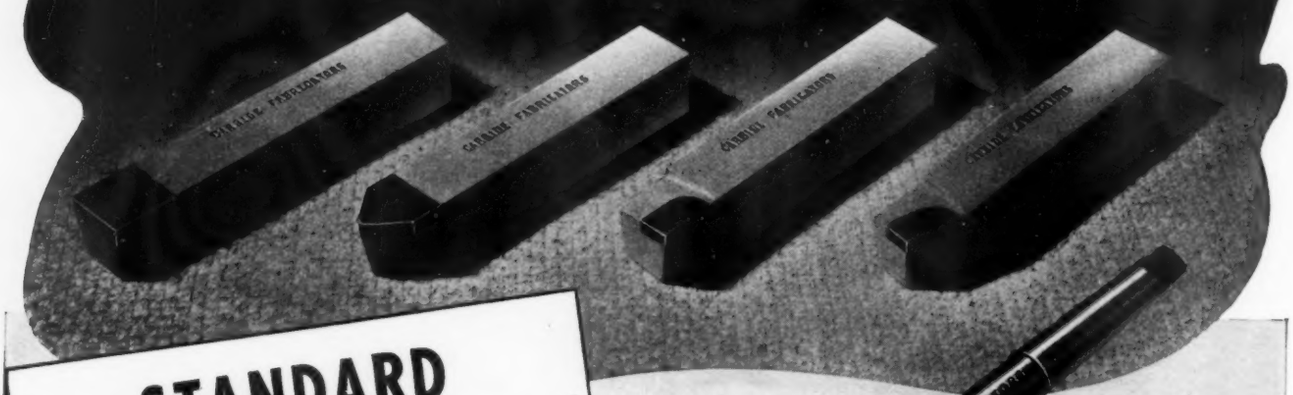
Speed is the vital factor in today's war production—speed plus the accuracy that is necessary for the unfailing performance of guns, warships and planes. Let us show you how broaching methods, speeded up, modernized and made more accurate by Lapointe engineers, can help you put your war production on a more efficient basis.

LAPOINTE

MACHINE TOOL COMPANY

HUDSON, MASS.

To Meet Your *Immediate* Requirements
For TURNING, FACING, BORING and REAMING JOBS



STANDARD
Cemented-Carbide Tipped
TOOLS

• Illustrated are the standard tools produced and stocked by Carbide Fabricators. Even under present conditions, our rapidly increasing production of these tools makes it possible for us to meet almost all delivery requirements. They are available for use in your present production — when you need them most.

The tools shown above will meet the majority of your needs for turning, boring and facing operations. Types are available for cutting of non-ferrous materials, cast iron, bronze, etc., and also for steel cutting.

Carbide Fabricators' standard reamers meet innumerable requirements in present day production. Expansion reamers are absolutely positive in locking for size. They provide maximum expansion of blades to provide long life. (Expansion of .030" in half inch reamer.) Their simple construction assures trouble-free service. Solid reamers are held to extremely close tolerances, and manufacturing methods such as the hardening of bodies to Rockwell 58C assure exceptional durability.

WRITE FOR COMPLETE CATALOGS LISTING SIZES AND PRICES

We are authorized suppliers of Carboloy, Vascoloy-Ramet and Firthite cemented-carbides.

Carbide Fabricators ROYAL OAK MICHIGAN

DIVISION OF MORSE TOOL COMPANY • DETROIT

LEWIN-MATHES
ROTATING SHELL BANDS AND SEAMLESS TUBING
of pure copper or gilding metal

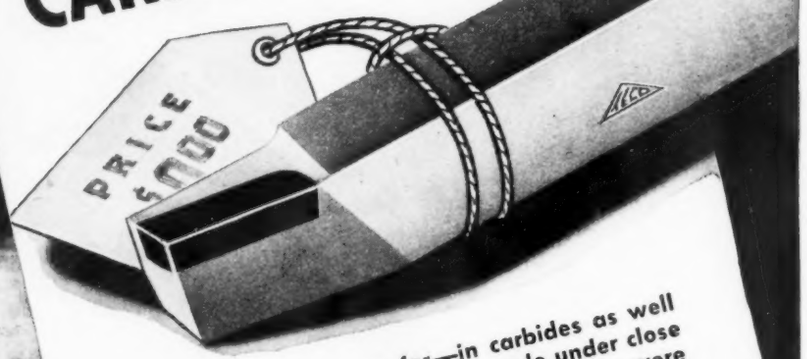
Our ever growing facilities enable us to meet your urgent needs.

LEWIN LM MATHES

LEWIN-MATHES COMPANY • • SAINT LOUIS, MISSOURI

Water Seeks its Own Level

. . . and so do CARBIDE PRICES!



You get what you pay for—in carbides as well as any other industrial product made under close technical control. When Tungsten Carbides were introduced, most manufacturers were on an equal footing from the standpoint of experience, methods and costs. As time went on, however, differences inevitably developed in skill, quality and—recently—price.

Most carbide manufacturers have been making the material for little more than a dozen years. We've been doing it for over twenty-five. And today we use all the knowledge and skill of a quarter-century to turn out only the best Carbides it is possible to produce. Many of America's best known concerns—our good customers—are convinced that TECO CARBIDE TOOLS hold their cutting edges longer, cut at higher speeds and produce more pieces between grinds.

TECO policy will continue to be "Quality first—then price."

TECO CARBIDE TIPS FOR IMMEDIATE SHIPMENT. Standard grades, styles and sizes.

TUNGSTEN ELECTRIC CORPORATION

568 39th STREET . . . UNION CITY, NEW JERSEY

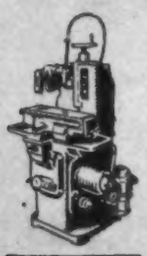
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects and Builders Building, Indianapolis, Ind.

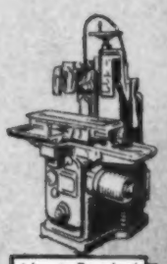
TECO

Pioneers in Tungsten Carbides for over a Quarter Century

Engineered Production

Turning Time Reduced
From 17 to 7 minutes
Quick Set-Up
Sundstrand Automatic Lathes run on cycles of rapid approach, feed, quick return of 250" a minute. These are set up quickly and changed over easily by adjusting dogs on a graduated disc, as indicated at right. No cycle-control cams required.
Rapid Approach
Quick Return
Feed


No. 00 Rigidmil


No. 0 Rigidmil

No. 1 Rigidmil

For Quick Facts

Get this booklet. See illustrated details of design and construction, 28 cycle diagrams, specifications and other data. Write *today*. Ask for Bulletin 104.

Fluid-Screw Rigidmil

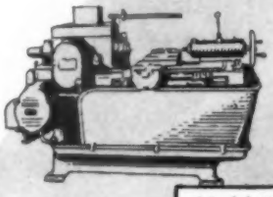
On Aircraft Engine Parts

142% Increase... Engineered Production and a Sundstrand Automatic Lathe increased output for turning operations on propeller shaft sleeves 142% over former method. This airplane engine part, run in lots of approximately 200, is made in nine different sizes each requiring a different set-up. The Sundstrand Automatic Lathe illustrated handles all nine sizes... is readily changed from one size, or job, to another. Quick set-up of cycle is outlined above. Establishing most efficient spindle speeds, feeds, and holding accurate sizes is equally simple. Additional Sundstrand Automatic Lathes in same plant show similar production increases on a wide variety of airplane engine parts turned in both small and large quantities.

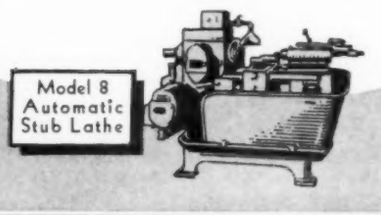
Why is this Possible?... Because the Sundstrand Automatic Lathe cycle control enables change-over from one job to another in 20 to 30 minutes. Thus the advantages of a fast automatic operating cycle, high rapid traverse rate of 250" per minute, and multiple tooling, all of which are necessary for maximum stock removal and high production, are available for short run work.

Close Limits at Less Effort... With a Sundstrand Lathe the operator only has to change work pieces and start the automatic cycle. The lathe does the heavy work and maintains uniformly close limits. Usually the operator can run two or more machines.

At Your Service... Airplanes, arms, ammunition, engines, ships, tanks, trucks, tractors, transport vehicles — no matter *what* war equipment you make, Sundstrand Automatic Lathes give you important proved and exclusive advantages on any metal-turning in their field. Our Engineered Production Department is at your service for making most effective use of these advantages. Simply send us accurate data on your turning requirements.


Model 12 Automatic Stub Lathe

Sundstrand Machine Tool Co.
2533 Eleventh Street, Rockford, Illinois, U. S. A.


Model 8 Automatic Stub Lathe

Model 10 Automatic Stub Lathe

In their respective fields, Sundstrand machine tools are unexcelled for high production, accuracy, and lasting value." Write for complete details.

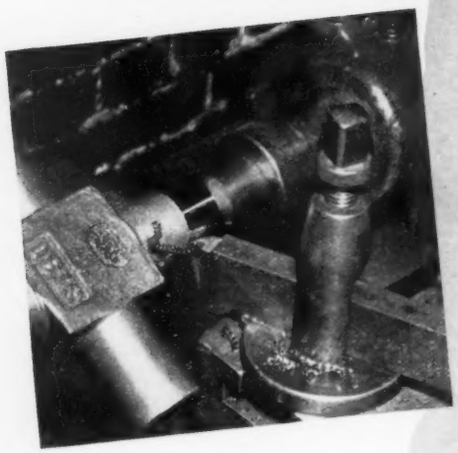
RIGIDMILS · STUB LATHES

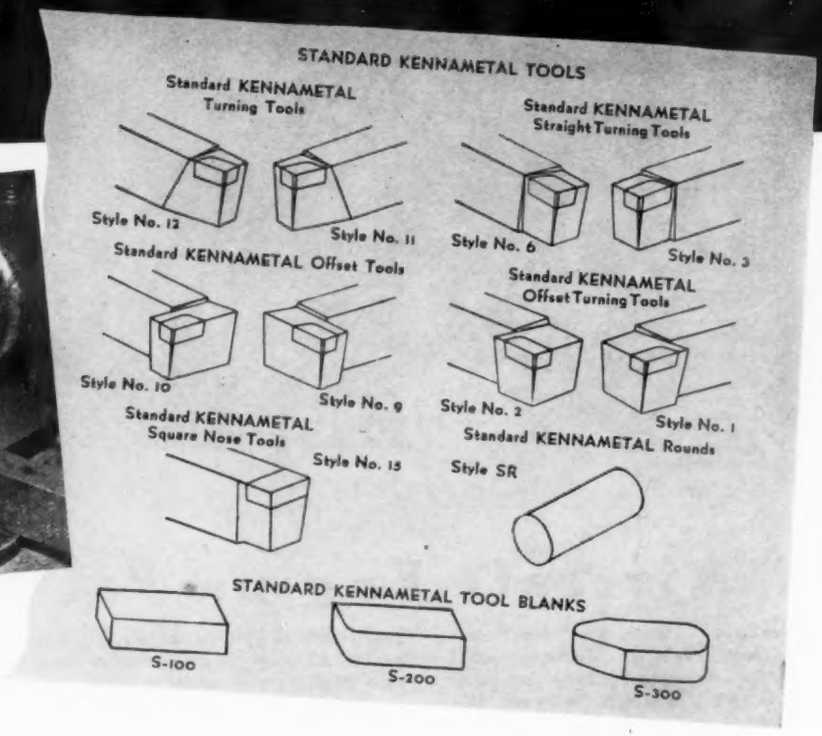
Hydraulic Operating Equipment — Drilling and Centering Machines

9 out of 10 steel-cutting jobs

CAN BE HANDLED QUICKLY and CHEAPLY

with these standard KENNAMETAL* tools and blanks





★The illustration shows ten standard styles of KENNAMETAL tools. They will be found suitable for the majority of turning, boring, and facing operations on steels hardened up to 550 Brinell. Save time by using these standard tools, or by ordering KENNAMETAL blanks and brazing your own tools.

All KENNAMETAL tools are more economical and more efficient than ordinary ones. Their great hardness, wear resistance and crater-resistance makes them outlast other tools, and do more work in any given time.

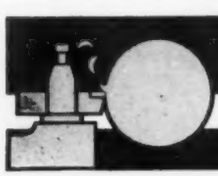
★ INVENTED AND MANUFACTURED IN U. S. A.

Write for

THE KENNAMETAL VEST POCKET MANUAL

Get the facts about KENNAMETAL! Write for a copy of the Vest Pocket Manual containing full details.

Visit the KENNAMETAL Booth C-100 at the National Metal Congress.

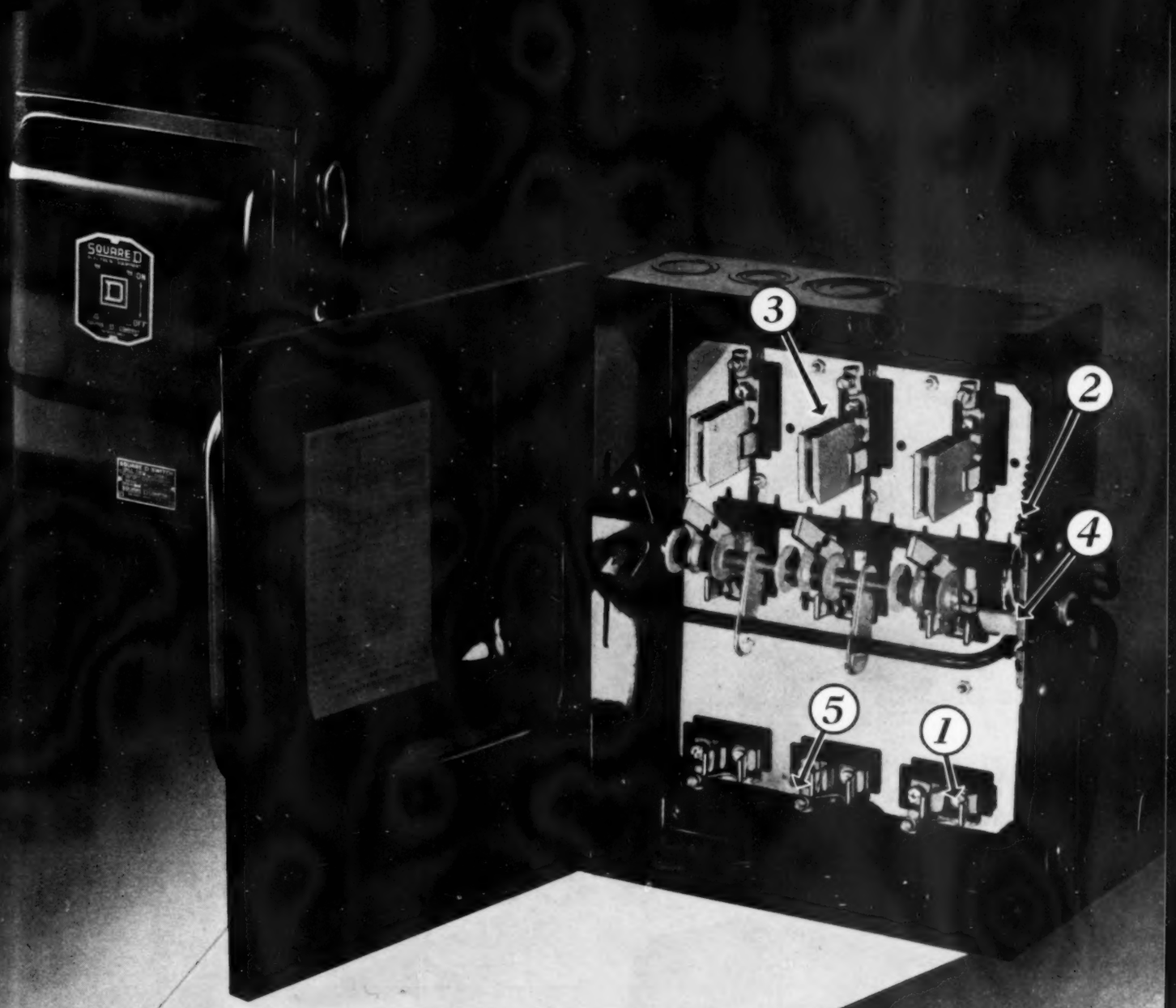


McKENNA METALS Co.

103 Lloyd Ave., LATROBE, PA.

FOREIGN REPRESENTATIVES: U. S. STEEL EXPORT CO.
(Exclusive of Canada, Great Britain and Possessions)

KENNAMETAL THE All American CARBIDE



FOR HEAVY AND CONTINUOUS DUTY—
SQUARE D SAFETY SWITCHES

1 **Positive Pressure Fuse Clips** reduce heating at the contact by more than 60 per cent. Steel reinforcing springs provide long contact life and positive automatic gripping of the fuse.

2 **Compression Spring** provides quick make and break. Long life is ensured because it is operated in compression only. Spring gives switch a high breaking speed which prevents burning of contacts.

3 **Square D Arc Suppressors** on switches above 250 volts, greatly minimize the arc by cooling and confining it and increase the rupturing capacity by more than 500 per cent. Square D switches equipped with Arc Suppressors rupture the current in 1/100 of a second, even at low power factor.

4 **Interlock Mechanism** has few operating parts and is compact, affording ample wiring space on both sides of switch. It prevents the switch door being opened when switch is "ON" or operating switch when door is open. Authorized inspection of switch can be made by means of a key.

5 **Solder-Solderless Connectors** may be used either as solderless connectors or as solder lugs. Each connector covers a wide range of wire sizes and has only two parts—a cast lug and a special brass setscrew. Approved by Underwriters' Laboratories, Inc.

Call in a **SQUARE D** *man*

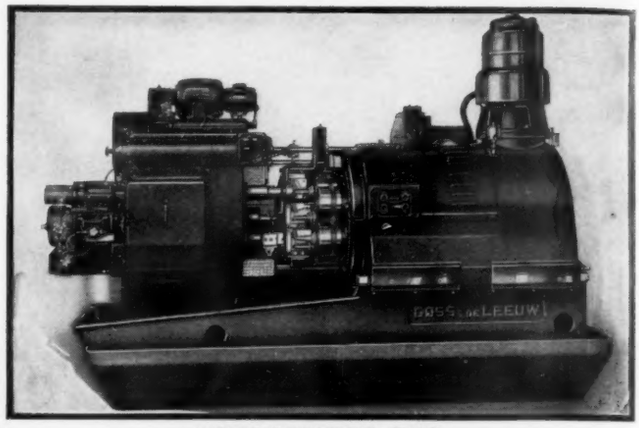
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

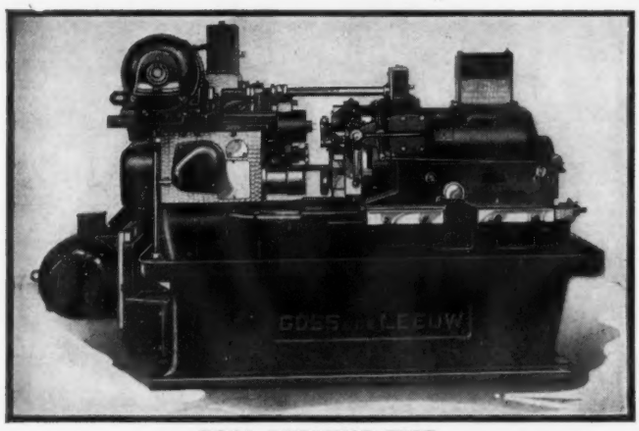
IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



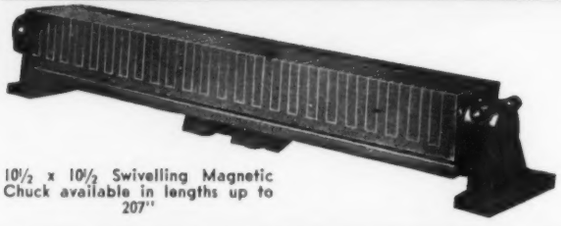
TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.



10½ x 10½ Swivelling Magnetic Chuck available in lengths up to 207"

No. 618 Rectangular Magnetic Chuck available in sizes up to 30" x 96"

Your every need can be met with

DEMAGNETIZERS

Send for a copy of Bulletin K7 giving complete information on Walker D.C. and A.C. Demagnetizers. These units —in 110 and 220 v.—are suitable for removing residual magnetism from a wide variety of work, are convenient and highly efficient.

WALKER MAGNETIC CHUCKS

Aside from the fact that Walker Magnetic Chucks are of tried and proved design and construction, the big advantage in coming to Walker for your needs is the fact that you can be certain that you will exactly meet your needs. Regardless of your requirement, there's a Walker to handle it.

The completeness of the Walker Magnetic Chuck line makes it possible for you to standardize on these well-known and widely accepted units. Every type of magnetic chuck is available in a wide range of standard sizes including Rectangular, Swivelling, Vertical Face and Rotary. Every design is modern, convenient, with maximum uniform magnetic strength over the entire surface.

Get all the details pertaining to sizes, types and construction by wiring today for a copy of Bulletin W4.

Also

Walker is prepared to furnish promptly and at reasonable price any special magnetic chuck that may be required for special service conditions. Outline your problem and ask us to submit details and quotation.

Style B Face Plate for Standard Rotary Type Chucks available in sizes up to 66" diam.

No. 410 Universal Swivelling Magnetic Chuck

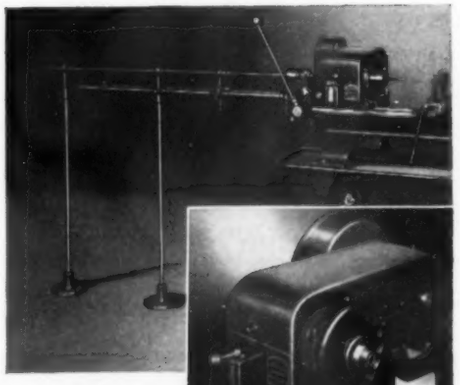
O. S. WALKER CO. Inc., Worcester, Mass.

SPECIFICATIONS
1 Swing Over Bed, 10½"
2 Bed Length, 43⅛"
3 Spindle Hole, 25/32", Capacity, ⅝"
4 Preloaded Precision Ball Bearing Spindle Mounting
5 12 Spindle Speeds, 30 to 1450 R.P.M.
6 Cross Slide Stroke, 3¼"
7 Six Position, Automatic Indexing Turret
8 Stroke of Turret, 3¼"
★ ★ ★

NO 830 LOGAN ⅝" CAPACITY HAND SCREW MACHINE

THE NEW LOGAN TURRET LATHE MEETS SPECIFIC NEED FOR WAR PRODUCTION

The recently announced Logan Turret Lathe was developed to supply the demand for a durable small hand screw machine capable of accurate, continuous production. Small parts made from bar stock of ⅝" diameter and less can be turned out with the same speed and precision as that of larger machines and thus release the latter for heavier work. Built to rigid and exacting specifications and the same high standards as the other lathes in the Logan Line.



The Logan Bar Feed is offered as an accessory for the No. 830 Hand Screw Machine. Maximum capacity, ⅝" round stock. Maximum stroke, 2". Patented safety cam action locks collet and operates bar feed.

The Logan Speed Collet fits the No. 830 Lathe or others with a 1 1/2" x 8 thread spindle nose feed. Quick acting. Positive squeeze grip. No keys or wrenches needed.

LOGAN ENGINEERING COMPANY • Chicago, Illinois

Logan

A NAME TO REMEMBER WHEN YOU THINK OF LATHES

Is your shop geared for emergency production needs?

How about *management?* Have you taken every means of improving your shop layout and handling of tools, work, records, men, etc., so as to eliminate bottlenecks and put through the greatest amount of profitable work in the busy days ahead? Here's a great new book by the famous machine-shop writers, Fred Colvin and Frank Stanley, in which owners and managers, foremen and shopmen can find practical means of straightening out all the intricacies of running a machine shop for maximum productiveness.

Running a Machine Shop

By Fred Colvin,
Editor Emeritus,
American Machinist,
and Frank Stanley,
Editor,
Western Machinery and Steel World,
403 pages, 6x9, 146 illustrations.. $3.50

HERE is the book to answer the questions that don't have to do with machine operations, yet that affect shop profits in many ways. How to set up and equip the shop, how to plan work, how to inspect and control it, where economies may be made, how production may be improved, how to keep records, how to manage men—these are the sort of important problems explained here on the basis of successful methods now in use.

Here are valuable pointers on:

—selecting machinery
—buying used machinery
—keeping machines in condition
—timesaving tool trucks
—moving work about the shop
—conveyors in the job shop
—toolroom layouts
—making the tool crib pay
—allocating machine hours
—shortening work travel
—estimating on contract work
—estimating from blueprints
—foremen's meetings
—farming out work
—planning for slack times
—modernizing a shop
—where and when to inspect
—saving motions in assembly
—etc., etc.

SEE IT 10 DAYS—SEND THE COUPON

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McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street, New York, N. Y.

Send me for 10 days' examination, subject to approval or return, Colvin and Stanley's Running a Machine Shop. At the end of 10 days I agree to pay $3.50, plus a few cents for postage and delivery, or return the book postpaid. (We pay postage on orders accompanied by remittance.)

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Address .....

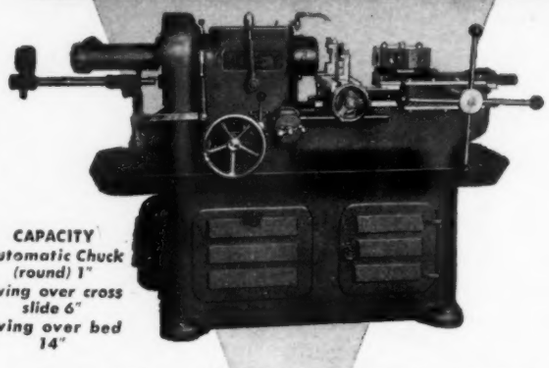
City and State .....

Position .....

Company .....A. 9-17-42

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds

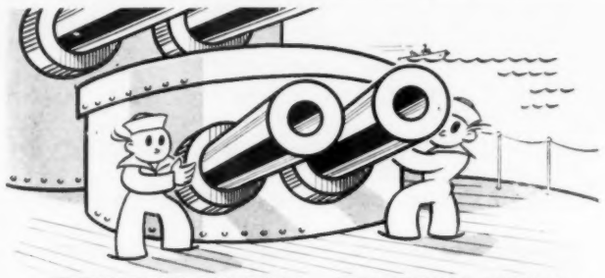


CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

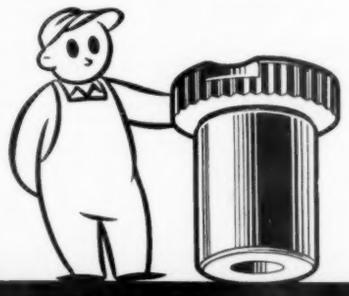
Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

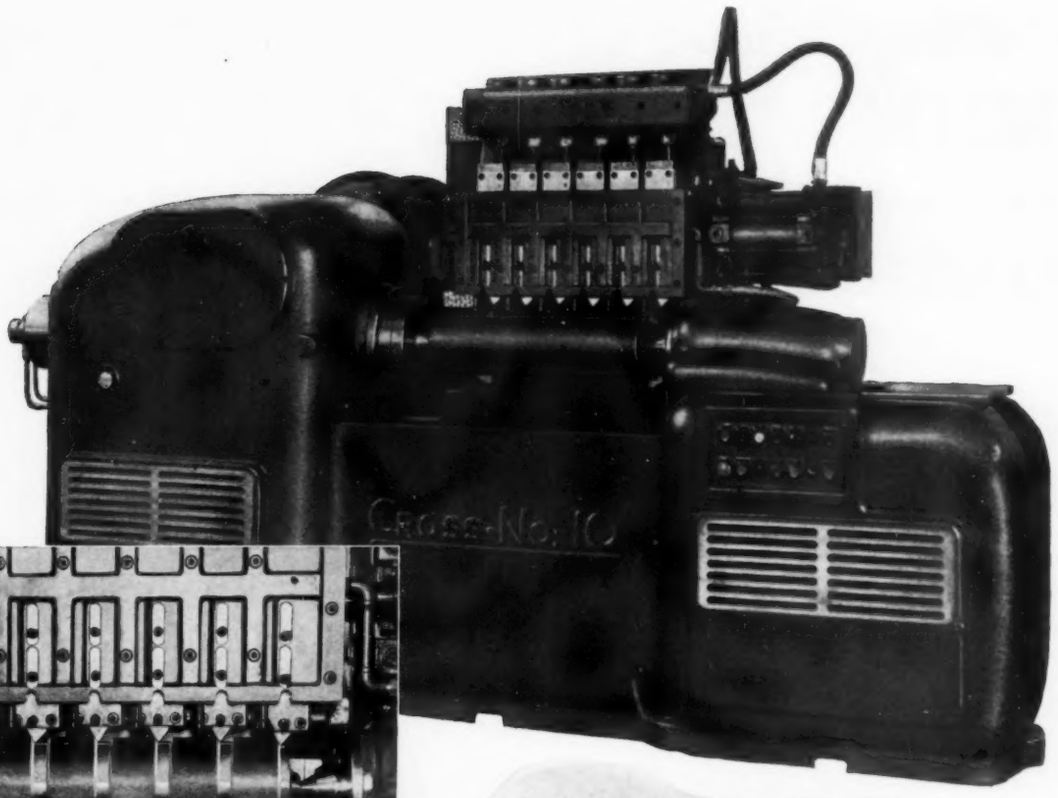


THEY'RE NOT BIG GUNS—BUT THEY'RE MIGHTY IMPORTANT TO UNCLE SAM'S ARMS PROGRAM

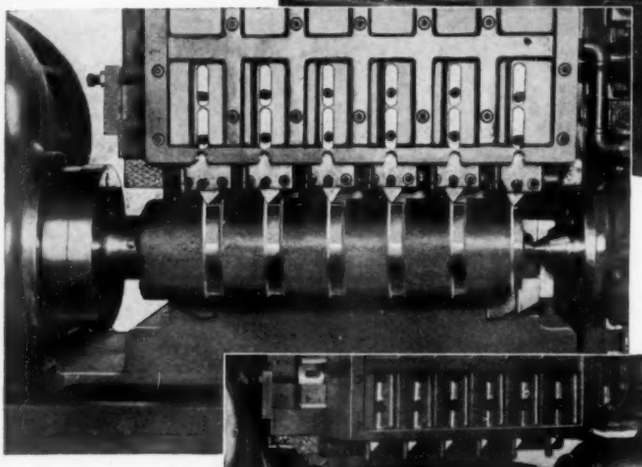
In plants from Maine to California Universal Drill Bushings are busy doing their bit toward stepping up the speed and efficiency of America's Arms production. Because of their straight and round superfinished bores, Universal Bushings save tools and assure accuracy. Write for further facts.

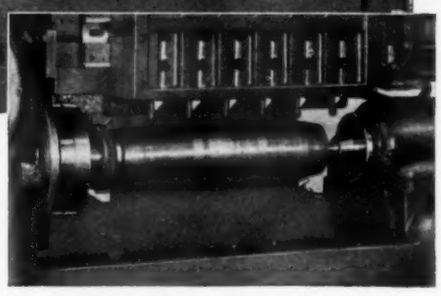


UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN



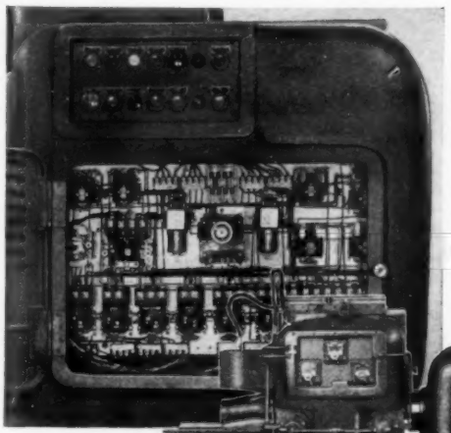
The overhead tool carriage is constructed to provide the tools with rigid support close to the cutting edge. Uniform cutting pressure is maintained with a smooth, powerful hydraulic feed. Chips fall clear of the work and allow a free cutting action.



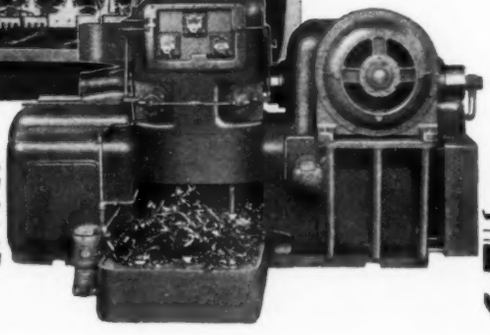


Six turning tools, a cut-off tool and a base facing tool all cut at the same time, and without vibration, while finishing large caliber rough forgings to accurate bottle form in one operation.

CROSS Shell LATHE



Handles and levers have been eliminated. Everything is controlled by push button — clamping, the tailstock, the spindle clutch, the automatic operating cycle — and all are interlocked for safety



The motor is off the floor and coupled directly with the clutch shaft to eliminate belts. Automatic chip disposal is provided.

Cross Shell Lathes are noted for their productive capacity, durability and ease of operation. They are built to take the fullest advantage of multiple carbide tooling with an automatic operating cycle and ample capacity for handling up to 100 horsepower. The merit of their original design and the quality of their construction are reflected in the performance records of the leading shell shops at home and abroad.

CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

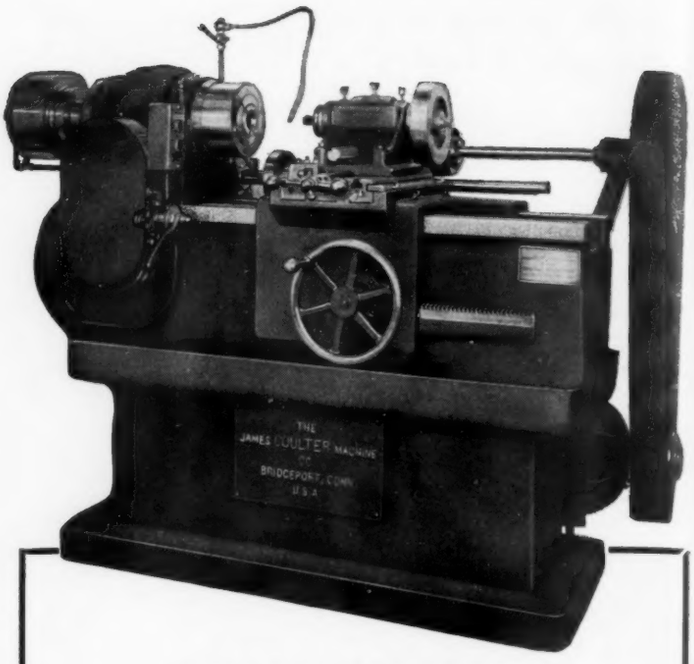
101

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

Dead Front, Safety Type Switchfuz Switchboard, with hinged pull-out type units.

FA TRADE MARK

Distribution Type Switchboards

are built in a wide variety of types, to meet all industrial conditions — Live Face; Dead Front; Safety Type, Switchfuz, Shutlbrak, or Circuit Breaker . . . They are assembled complete in the factory before shipment, and, as far as possible, are shipped with all apparatus (except instruments) in place . . . Special engineering service is available . . . Quotations will be submitted upon receipt of specifications and complete list of requirements . . . Send for complete catalog data.

Frank Adam
ELECTRIC COMPANY
ST. LOUIS

EFFICIENT PUMPS SAVE TIME-MATERIAL-MACHINES

You can depend on these Quality Pumps — Geared, Vane or Centrifugal.

B·S Brown & Sharpe Mfg. Co., Providence, R. I., U.S.A.

BROWN & SHARPE PUMPS

SCRAP PILE YIELDS A USABLE 52 YEAR-OLD HENDEY LATHE

A recent order for repair parts . . . uncovers rebuilt HENDEY . . . busy on war work

●

About two and a half years ago an enterprising used machinery dealer, specializing in rebuilding machine tools, found this lathe in a scrap pile in the metropolitan area. This company, recognizing the make of lathe bought it and rebuilt it for their own use.

Inasmuch as we were unable to furnish needed missing parts, on account of the age of the machine, the owners, with characteristic enterprise, made workable parts to take the place of those missing.

After a while this lathe was sold to a manufacturing company in the near vicinity who were able to enter into the manufacture of needed war materials and at the present time the lathe is being used to turn out blanks from high speed steel for shell dies. These blanks vary in diameter from 4" to 8".

Hendey has always claimed rigidity and endurance for its lathes. This recently brought-to-light story of this old Hendey lathe is just another example of convincing proof that Hendey lathes are and will be built for many, many years service.

HENDEY

"Blount"

MOTOR HEADSTOCK LATHE

Offering increased production, ease of operation, quietness and safety . . .

Modern in every detail the Blount unit type Motor Headstock Lathe can be depended on for superior performance.

Motor headstock is of anti-friction bearing enclosed construction and aligned with the bed. Motor is a ½ H.P. ball-bearing 4-speed type, 220V, 3 phase, 60 cycle. Bed is designed for a 12" swing.

Controller, of enclosed dust-proof type, is provided with magnetic starter having overload and low voltage protection. Speed control handle conveniently located on front of headstock, makes standard spindle speeds of 600, 1200, 1800 and 3600 R.P.M. quickly and easily available. Combination mechanical break and cut-out switch and automatic disengaging spindle lock are provided.

Bed is of heavy construction, generously cross-braced for maximum stiffness, rigidity and balance. Standard bed lengths of 4', 5', 6', 7' and 8' are available.

Tailstock is of open-side design, lever-clamped to bed. Stock is self-ejecting. A rugged quick action tool rest provides ample surface for all jobs. Cabinet type legs provide convenient storage space.

Standard equipment includes: 8" combination rear faceplate and hand wheel, 6" inside face plate, 3" screw chuck, ¾" spur center, ¾" cup center, 7" and 10" hand tool rests and 2½"x4" angle rest.

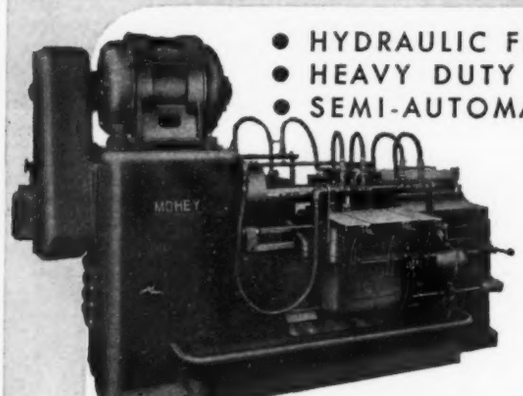
Complete detailed specifications available on request—Ask for Bulletin D-17

J. G. BLOUNT CO.

Everett, Mass., U. S. A.

Suitable for 105 M.M. to 155 M.M. Shells

- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC



The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC

410 BROOME STREET • NEW YORK, N. Y.

L.W

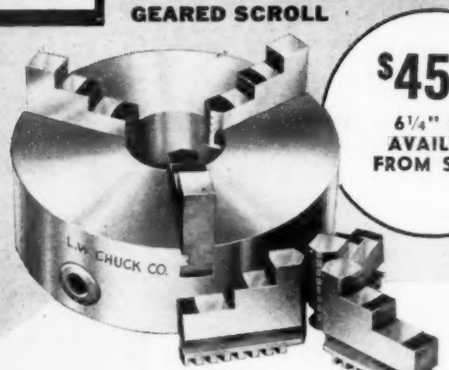
LATHE CHUCKS

3-JAW UNIVERSAL

GEARED SCROLL

$45.00

6¼" SIZE AVAILABLE FROM STOCK



A 3-JAW UNIVERSAL CHUCK

Combining strength with accuracy making it readily adaptable for either light or heavy duty work.

- ★ Body-semi steel casting, ruggedly designed for maximum strength.
- ★ Jaws-Steel, hardened and ground, accurately fitted. Set of reversible jaws furnished.
- ★ Scroll and Pinions-Made of high grade steel, accurately cut. T handle wrench furnished.

This chuck is guaranteed to run true, is desirable for either Lathe or Screw Machine work.

Also Mfr's of
Ind. Lathe Chucks
Dividing Heads
Power Hack Saws
Magnetic Chucks
Demagnetizers
Milling Mach. Vises

L-W CHUCK CO.

1-7 N. ST. CLAIR ST., TOLEDO, OHIO

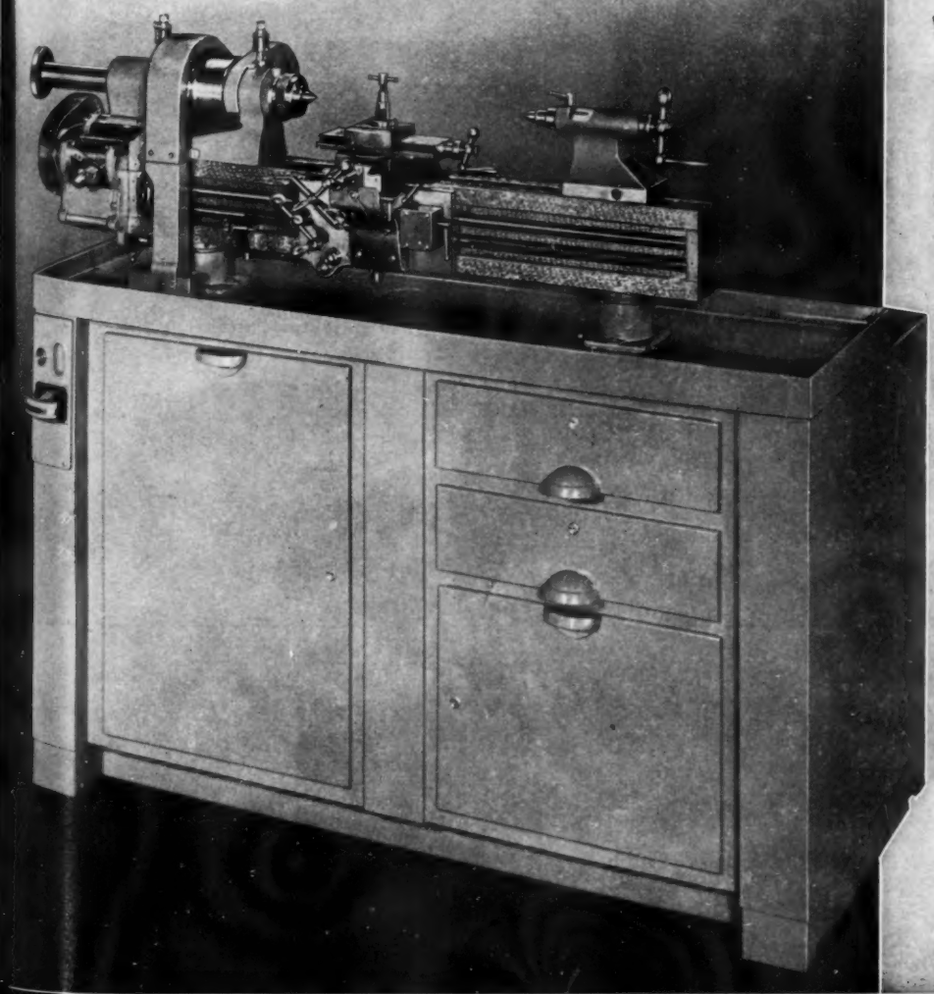
RIVETT

608 WITH VEE BELT DRIVE

In Tool-Making and Instrument Shops It Will Handle Great Variety of Jobs in Minimum Time

Basically, the Rivett No. 608 is a small but exceedingly powerful engine lathe. As such it is peculiar in having slide areas equal to those of lathes twice its size. Its bronze-bearing spindle runs smoothly and with extreme truth, and is capable of heavy or light cuts and severe end thrusts. Finely made attachments for milling, spiral cutting, slotting, relieving, taper turning, ball turning, grinding, forming and multiple operations enable the user of a fully equipped No. 608 to finish his work completely without recourse to other machines, and throughout his entire series of operations to utilize the inherent precision of the lathe itself.

Safety interlock protects the carriage from accidental engagement of both power feed and lead screw at one time. Lead screw and feed rod are guarded from injury by deeply inset mounting in bed. Carriage wipers sweep dirt and chips from the bearing surfaces of the bed. Three-point pedestal supports assure against distortion imparted from lathe mount.



Milling

Multiple Operations

SPECIFICATIONS

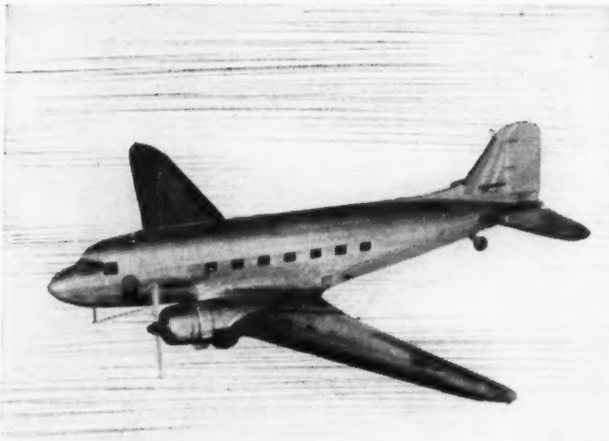
With Flat or Vee Belt Drive

Swing over bed, dia.	8½"
Length of bed	40"
Distance between centers	18¼"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of top slide	5¼"
Slide rest, travel of cross slide	4½"
Feed range, through gear box	.0015" to .0220"
Thread range, through gear box	10 to 144
Tailstock spindle travel	3¼"
Spindle speeds:	
Flat belt drive—12 speeds	39 to 1295 r.p.m.
Vee belt drive—12 speeds	25 to 1500 r.p.m.
Weight of lathe, mounting and drive:	
Flat belt drive, net	900 lbs.
Vee belt drive, net	1050 lbs.

For Further Description Write for Bulletin 608

608 GEARED BENCH LATHE

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT



It takes *all kinds* of planes to win a war—fighter planes, bombers and top-speed air transport planes like the great fleet that flies AIR EXPRESS day and night for this Nation's war production program.

Essential war materials are given air transportation priority. For details phone Railway Express Agency, AIR EXPRESS DIVISION, or any airline.

AIR EXPRESS

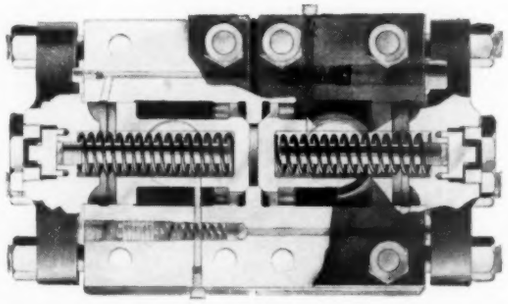
Division of **RAILWAY EXPRESS**

● A problem presented—studied—solved! It's the firm policy of BAYARD to follow through every assignment in the designing, engineering and creating of machinery for a specific purpose with ingenuity and skill born of long years of experience.

SPECIAL VALVES
ELECTRO-HYDRAULIC
HOISTING MACHINERY
CRANES

DUPLEX RELIEF VALVE
for Closed Hydraulic Systems

Relieves excessive pressure from the high side to the low side, independent of which side of the system happens to have excessive pressure.



BAYARD

The coveted Navy "E" Pennant—awarded to Bayard for excellence in fulfilling Naval contracts

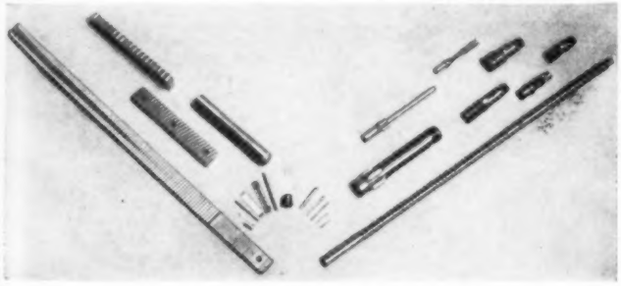
M. L. BAYARD & CO., Inc. • ENGINEERS • MACHINISTS • PHILADELPHIA

DALZEN PLANT EXPANDED 3 TIMES

to meet demand for super-accurate DALZEN THREAD GRINDERS BROACHES, TAPS and THREAD HOBS

Today we're turning out Dalzen Thread Grinders—also taps and Broaches —24 hours a day—to speed production of Army, Navy and Air Equipment for this Country and our Allies. That's because Dalzen Thread Grinders are super-accurate and speedy and highly efficient tools for the grinding of threads up to 4" and 10" in length, right and left hand, U. S. Standard, modified and full British standard and special forms. Compact, with vertical design that insures constant equilibrium, Dalzen's versatile performance is a mighty factor in all-out production for Victory.

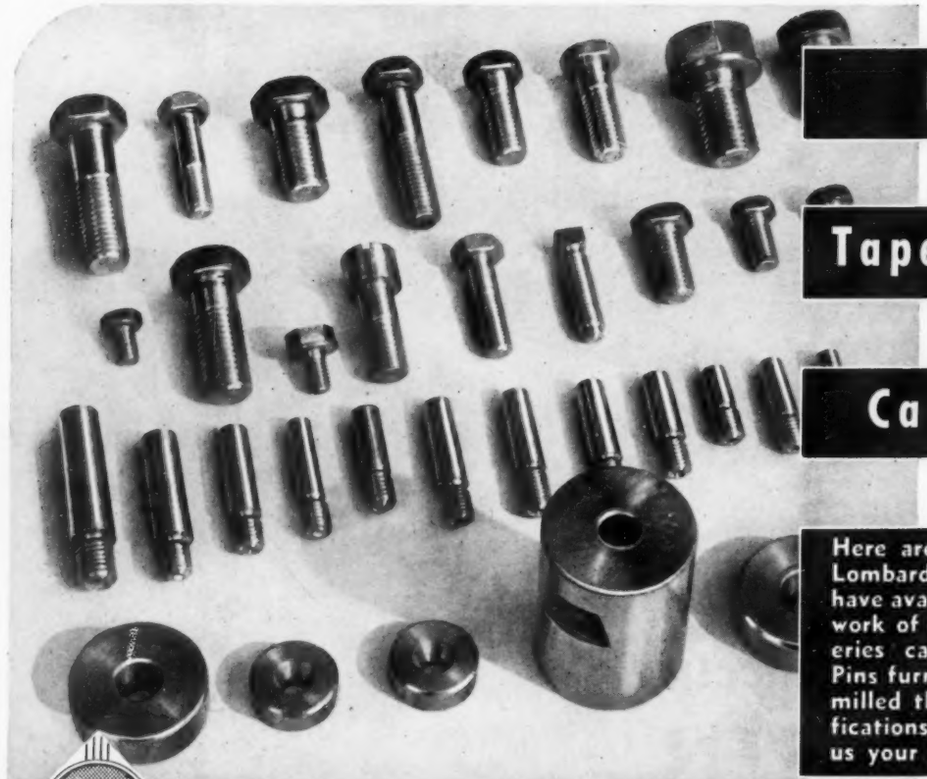
Do much more—take less floor . . .



Dalzen Thread Grinders, in addition to their speed and precision, means the most effective utilization of least given floorspace. This means that use this saved floorspace for added equipment or more efficient tool arrangement. Dalzen Taps and Broaches are also being produced to the same design precision standard. Write for new illustrated Bulletins.

Shown above are some of the broaches and taps manufactured by Dalzen. The broaches are made in rounds, flats or form. The taps are Whitworth and British Association form.

DALZEN TOOL & MFG. CO.
12255 E. 8 Mile Road Detroit, Mich.



BOLTS

Taper Dowel Pins

Cartridge Dies

Here are representative samples of Lombard precision manufacture. We have available capacity for additional work of this nature and quick deliveries can be made. Taper Dowel Pins furnished with either ground or milled threads. Sizes to your specifications. Send us a print — or tell us your problem.

LOMBARD GOVERNOR CORPORATION
200 MAIN ST., ASHLAND, MASS., U. S. A.

Now! A Complete Manual on MARKING DEVICES For Every Industrial Use

Request A Copy On Your Letterhead!

Plant Managers! Superintendents! Purchasing Agents! Production and Plant Engineers! Here's a book that will give you the answers to your marking problems. It contains hundreds of illustrations, with concise descriptions of Marking Devices for every Industrial Marking application. Yours for the asking . . . request a copy on your letterhead today!

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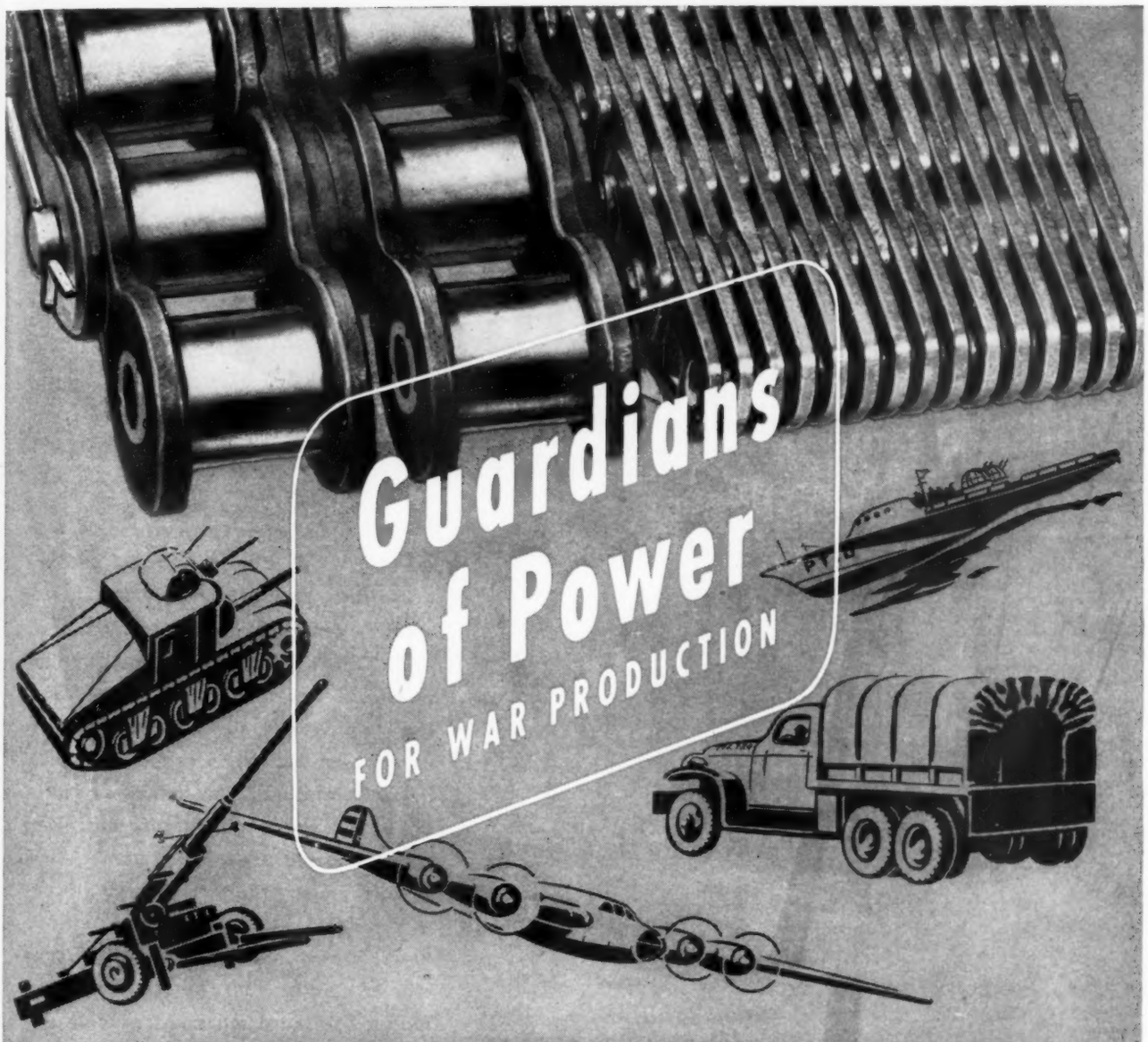
CRITERION Boring Heads Speed PRODUCTION

These Criterion heads save time! Smooth, compact, rigid! Large, easy-to-read, graduated dial. Lead screw is hardened tool steel. ITS THREADS ARE GROUND FROM THE SOLID AFTER HARDENING, assuring constant accuracy. Parts subject to wear are hardened. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3" ½" and 1" bar capacity Ask your dealer, or order direct. Request free literature.

CRITERION MACHINE WORKS
BEVERLY HILLS CALIFORNIA
NEW YORK OFFICE 205 E. 42ND ST., N. Y.



To maintain peak war production, you need efficient transmission of power. Virtually, Morse Silent and Roller Chain Drives are guardians of power—a positive safeguard against creep, chatter, slippage and waste. Regardless of speeds, overloads, shocks, or elements, Morse Chain Drives deliver full power constantly at high efficiency. Maintenance is practically non-existent. Morse Representatives are ready to help you in your war production with chain drives engineered to the job.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

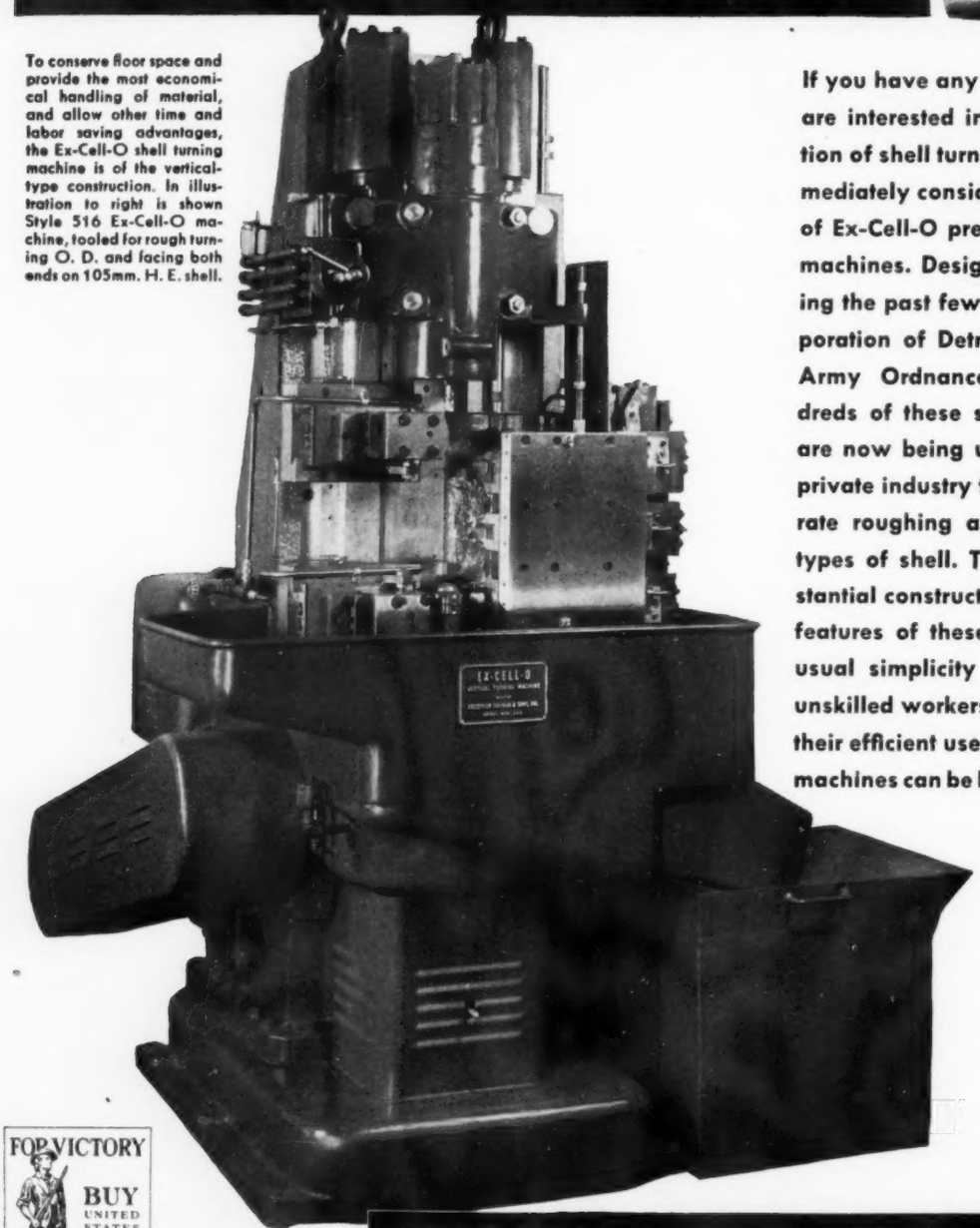
MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

FOR *Fastest* SHELL TURNING

EX-CELL-O PRECISION MACHINES FOR ACCURATE AND SPEEDY PRODUCTION . . . ROUGHING AND FINISHING . . . 75 TO 155MM. SHELL

These Ex-Cell-O machines, which are constructed specifically with feeds and speeds for the most efficient use of cemented carbide tools, are being tooled for either rough turning and facing or finish turning all sizes and styles of shell . . . from 75mm. to 155mm.



To conserve floor space and provide the most economical handling of material, and allow other time and labor saving advantages, the Ex-Cell-O shell turning machine is of the vertical-type construction. In illustration to right is shown Style 516 Ex-Cell-O machine, tooled for rough turning O. D. and facing both ends on 105mm. H. E. shell.

If you have any shell turning problem, or are interested in the most rapid production of shell turning work, you should immediately consider the many advantages of Ex-Cell-O precision-built shell turning machines. Designed and developed during the past few years by Ex-Cell-O Corporation of Detroit, in cooperation with Army Ordnance representatives, hundreds of these single-purpose machines are now being used in government and private industry for the speedy and accurate roughing and finishing of various types of shell. The general design, substantial construction, and semi-automatic features of these machines provide unusual simplicity in operation, allowing unskilled workers to be trained quickly in their efficient use. In many instances, two machines can be handled by one operator.

For construction details, actual production figures, and early delivery dates, wire or phone *today* to Frederick Colman & Sons, Inc., Detroit, Michigan (Telephone TYler 4-3207).

FREDERICK COLMAN & SONS, INC.
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THE WILL TO WIN

(as spontaneously expressed by a Cushman employee)

Some time ago when the enemy struck
"Right into high" went Cushman Chuck
Machines were pushed . . . with the dedication
"MAKE MORE CHUCKS to protect the nation".

We'll make the chucks for many a lathe
To turn the enemy into his grave
To build a gun . . . and finish a plane
And drive the Axis back again.

Some of the boys have gone to war
To fight for the things worth fighting for
So it's up to us to help this crew
That worked at a bench with me and you.

The more we produce and the more we give
Will make more certain our pals will live
They'll be thinking of us in foreign lands
With thanks for a chuck and for what it stands.

They know what it means as a tool of war
They know from the battle just what it's for
That without a gun there'd be no pluck
And THERE'D BE NO GUN without a chuck.

So all of us here at Cushman's work
Will boost production . . . never shirk
With a steady stream of chucks for the nation
. . . America . . . Cushman . . . cooperation.

Eugene Pilkington

A WORLD STANDARD FOR PRECISION

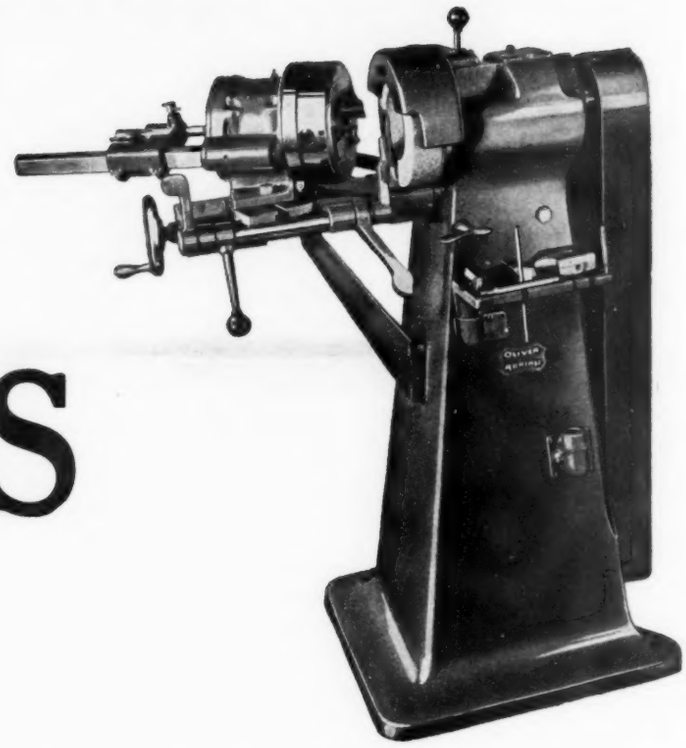
CUSHMAN

THE CUSHMAN CHUCK CO. CHUCKING ENGINEERS · SINCE 1862 HARTFORD, CONN.

How are your

DRILLS

Standing Up?



In spite of the demands for more speed and greater accuracy in war production your drills **must** stand up! And they must perform with "new tool" precision as long as they last. You can be sure of getting the last ounce of work out of every drill if you keep them in condition with the Oliver No. 510 Drillpointer.

By means of high speed, completely automatic action they produce accurate points on all drills from 1/4" to 3" in diameter. Any point angle from 82° to 160° can be produced, insuring the right point for maximum efficiency in any material. And the Oliver hollow-ground point with variable clearances assures lasting accuracy and longer wear on the toughest drilling assignments.

Don't Neglect Your Toolroom It's the Backbone of Production!

No matter what type of war production you are engaged in, you must get maximum efficiency and accuracy from every drill and cutting tool. Keep **all** your tools **always** in "right out of the box" condition with Oliver Drillpointers and Tool Conditioners. Full details will be sent on request.

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Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

CORRECT APPLICATION OF CUTTING FLUID INSURES LONGER TOOL LIFE

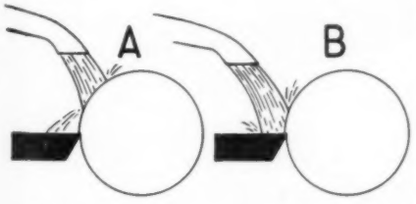
COOLANT IS VITAL FACTOR IN SCREW MACHINE PRODUCTION

The proper selection and application of cutting fluids is perhaps more important today than ever before, because of the faster speeds and feeds used, the use of tough alloy steels in munitions work, the heavy loads on the machines, the 24 hour-a-day operation of the machines, and the absolute necessity for 100% tool cutting efficiency.

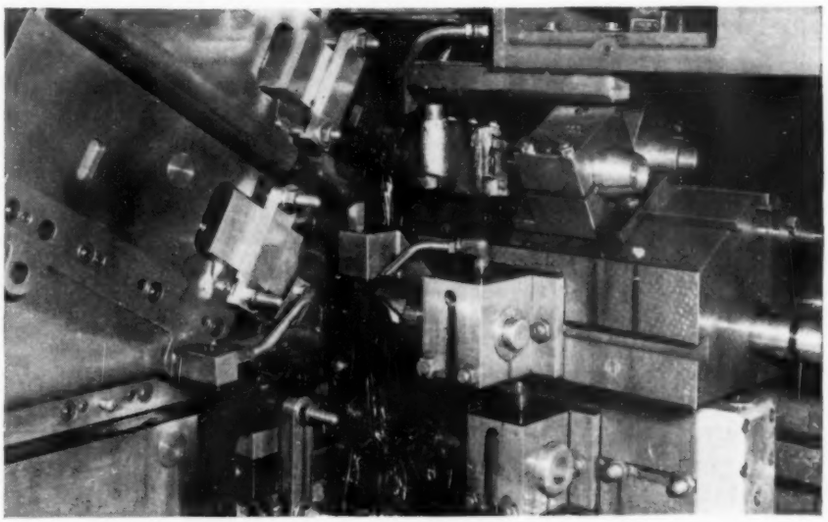
Automatic screw machine users have found that not only is the type of cutting oil used an important factor in obtaining maximum tool life, but that the correct application of the fluid to the tool and work is equally important.

Coolant Must be Applied to Both Tool and Piece

A common fault found in many screw machine departments is that the operator applies the oil only on the work and it is deflected from the tool. Figure A shows how the oil is deflected from the tool when it is incorrectly applied only to the work. Figure B shows how, on the other hand, a correctly applied flow of oil can do an effective job of reaching both the tool and the piece.



When machining at very high speeds, the cutting fluid must be so directed that it will not be carried away from the tool by fast moving chips. This may be accomplished in some cases by piping the coolant from beneath the tool, or by having a flow directed from both sides of the tool.



Here is a set-up view of the Greenlee Six-Spindle Automatic Screw Machine showing a typical application of the cutting fluid for efficient cooling and lubrication of both the tools and piece.

Oil Especially Important In Drilling Work

In drilling work it is important that sufficient oil be applied so as to work its way into the hole. The flow should be directed right into the flute of the drill, and if possible, from both the top and bottom sides of the tool. In this connection, it is well to remember that the coolant pipe should be held as nearly parallel as possible to the drill to prevent deflection of oil from the tool. In deep hole drilling and reaming work, oil drills or oil reamers, with the coolant piped through the tool itself, will give more thorough lubrication of the hole.

When using roller turners make sure that the pipe nozzle is as close to the tool as possible so as to lubricate the rollers as well as the cutting tool and piece.

On threading work it is important that the coolant be run through the die head to wash the chips out of the head.

Proper Temperature Control Adds Hours to Tool Life

The selection of a satisfactory cutting fluid depends upon several factors which may vary from job to job. A careful analysis of each specific job must be made before cutting fluid specifications can be established. The cutting feeds and speeds, the tool hardness, tool shaping, machineability of the metal, and the type of machining operation should all be carefully considered.

Cutting fluids when properly selected and applied will keep the tool cool and prevent it from being heated to a temperature at which hardness and resistance to abrasion are reduced. When temperatures are not properly controlled by coolants, the heat causes the cutting edge of the tool to soften and wear abnormally, which shortens tool life and requires the grinding of excessive stock from the tool when sharpening.

A good cutting fluid will also keep the work cool, preventing it from being machined in a warped shape, it will help provide a better surface finish on the part; it will aid in providing satisfactory chip formation; and it will help wash away chips, particularly in deep hole drilling.

MULTIPLE-SPINDLE DRILLING, BORING AND TAPPING MACHINES

Greenlee BROS. & CO. ROCKFORD ILLINOIS U.S.A.

AUTOMATIC SCREW MACHINES
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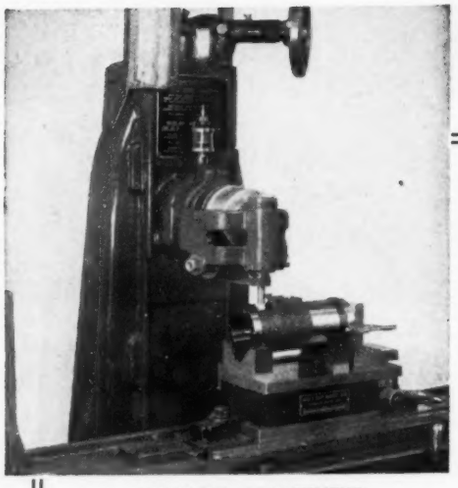

VERTICAL ATTACHMENT
Grinding Rectangular Opening in Trigger Casing

NEW! LIBERTY HI-SPEED GRINDING ATTACHMENTS

for quicker set-ups on a wide range of work

Accuracy and speed in grinding angles, slots, recesses and surfaces which are difficult to get at with large wheels or which mean slow set up with small wheels are assured with Liberty Attachments.

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Write for complete information specifying diameter of spindle head, type and make of grinder.

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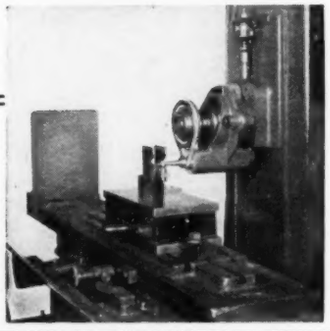

VERTICAL ATTACHMENT
Grinding Clearance of Broach Teeth

LIBERTY
TOOL & GAGE WORKS
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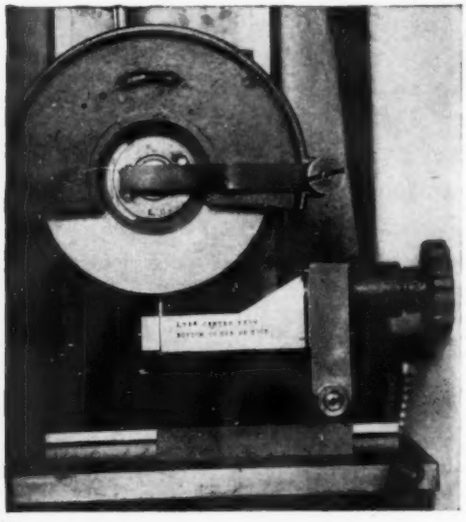


Simplify Grinding Radii and save Valuable Time • • • •

with the NEW C-66 RADIUS DRESSER

1—Faster, more accurate dressing

2—Ability to dress for radii where clearance angle on radius is involved

3—No necessity to remove wheel guard

4—Open and easy to see dressing operation

5—Ability to rotate 180° or 90° in either direction, with stop pins

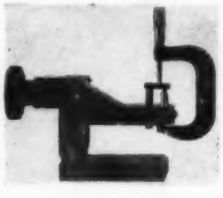
6—Simple setting of diamond

7—Ability to use several sizes of diamonds and hold them accurately in ground vee

8—Safety feature, hands are kept away from under the wheel

Price $72.50 without diamond, $5.00 extra with diamond

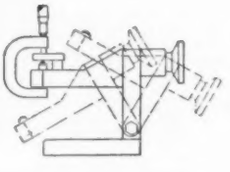
Diamond is set by measuring with micrometer from top of hood to bottom of arm.



Vee Ground in Center of Arm

.013 Male and Female Radius

.500 Male and Female Radius



Radius Dresser can be set at clearance angles for turning tools.

SCHULTZ & ANDERSON CO., 109 EDISON PLACE, NEWARK, N. J.

THE NEW NAME FOR SUPERLATIVE THREADING

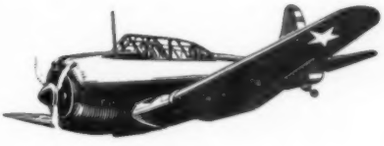
THREADWELL

THREADWELL
GREENFIELD

TAPS

that help TANKS ARMS

build better PLANES SHIPS



A steady flow of extra fine Threadwell Taps is helping set new records for threading tool performance in key war plants. Threadwell Taps are building a reputation that will last long after final Victory. This reputation is for accuracy and performance — it is built on the solid base of better men, better materials and better machines. It is enhanced by long experience and continuous research. It is crowned by the desire to serve — in war and in peace.

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Something *really NEW* in Surface Grinders!

New Delta *Toolmaker* Offers An Accurate Big Capacity Surface Grinder With Many Unique Features at a Remarkable Low Price

Never before has there been a surface grinder of this type and quality offered at so low a price. Designed and built to DELTA-Milwaukee standards—it is husky, accurate, versatile, easy to operate, portable—and incorporates many advantages not found in machines costing many times as much. It is ideal for surface grinding, tool sharpening and any grinding operations within its range—and because of its low cost and portability, can be quickly swung into any spot to free machines costing ten times as much.

Superior Features in Design and Construction That Make This An Outstanding Value

There are so many unusual features on this new Surface Grinder that it has to be seen and operated to be fully appreciated—but here are a few of the "highlights":

Improved, well-designed spindle—the "heart" of any Surface Grinder—made extra-long with bearing at either end, widely spaced. Forward bearing is large surface taper bronze bearing of design usually found only in much more expensive grinders—rear bearing is sealed-for-life ball bearing.

Special Wheel Mounting System—utilizes two-piece adapter so that either wheel, or wheel and adapter, can be removed. Thus once wheel has been trued up, wheel and adapter can be removed and replaced without need of re-dressing wheel.

Improved Table—Smooth operating, with conveniently located control handles—has long ways so that table never "hangs" over end of machine. Gibs provided so that all play due to wear can be eliminated. Micrometer collar, with wide graduations on the traverse adjustment permits accurate settings. The table is provided with T-slot for clamping fixtures or magnetic chuck in place.

Specially Designed Column—of one-piece construction, cast of high-tensile iron, normalized and accurately ground to close tolerances. Steel gib guides bracket yoke so it is always in perfect alignment. Entire column, together with bracket, can be rotated 360°.

SPECIFICATIONS. Maximum length that can be ground—13½"; Maximum width that can be ground—6"; Maximum space under 7" wheel to table—9½"; Maximum space under 7" wheel to B & S No. 510 Magnetic chuck—6"; Table surface 5¾"x12"; Traverse feed; one graduation is .001"; Maximum adjustment of wheel by means of micrometer is ⅜"; each graduation is .0005"; Minimum diameter cup wheel with standard guard in place 3½"; Maximum diameter wheel 7".

DELTA MILWAUKEE

Write for Special Bulletin

giving full details, prices and all specifications on this new DELTA-Milwaukee Toolmaker Surface Grinder. Get in touch with the nearest Delta Industrial Distributor or mail this coupon direct to The Delta Mfg. Co.

THE DELTA MANUFACTURING CO.
608-K E. Vienna Ave., Milwaukee, Wis.

Gentlemen: Please send me special bulletin on the new DELTA-Milwaukee Toolmaker Surface Grinder giving full specifications and prices.

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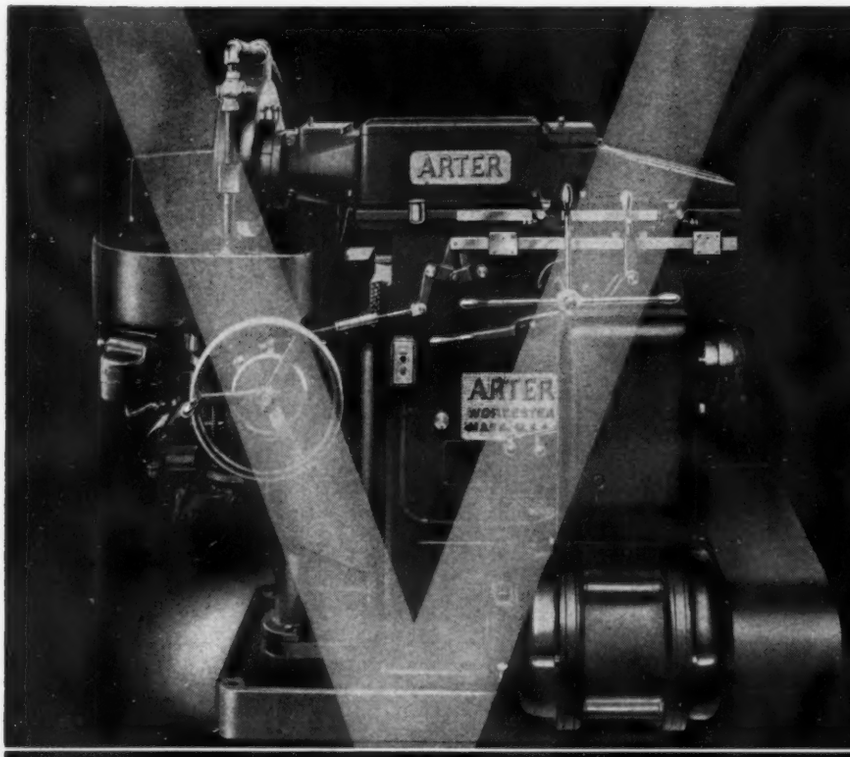

ARTER

V also stands for VERSATILITY.

Arter Rotary Surface Grinders give you wide versatility — precision surface grinding on a wide variety of surfaces.

Are you using your **Arter Rotary Surface Grinders** to their full capacity?

Arter grinding engineers are always at your service — to help you gain production-plus, the all-important need of the hour.

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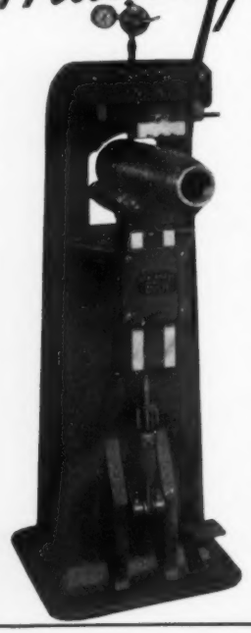

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Accessibility. Popular Model No. 4, showing wide opening for quick feeding of shell bodies Today universally used in defense industries. Can be tooled for hundreds of applications.

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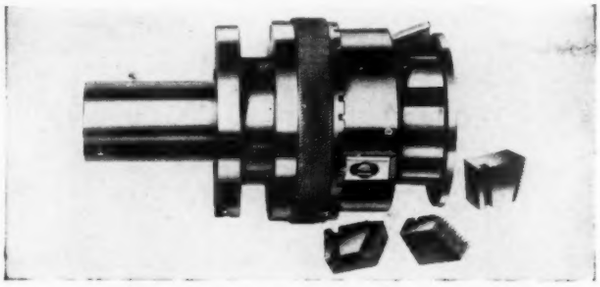

R-S REVOLVING TYPE YOKE CONTROLLED DIE HEAD

RICKERT SHAFER *Specialists* **IN THREADING TOOLS**

- AUTOMATIC DIE HEADS
- COLLAPSIBLE TAPS
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- SPECIAL THREADING MACHINES

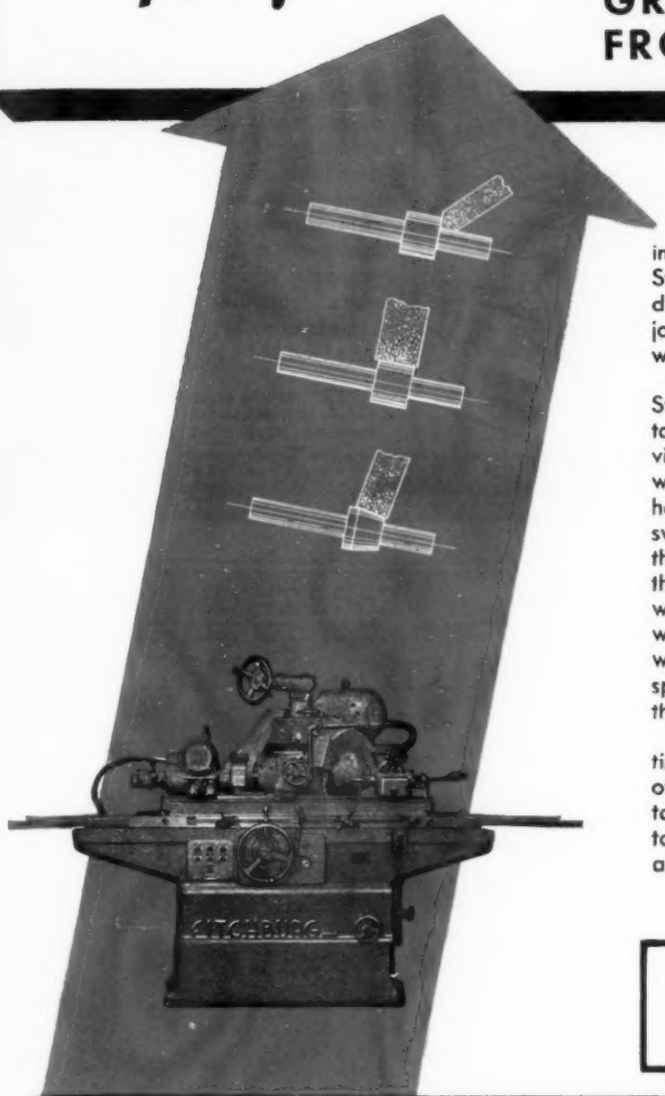
The RICKERT-SHAFER Co.

ERIE, PA.

New FITCHBURG ADJUSTABLE "TYPE C"

Angular Head Grinder

FOR PLAIN CYLINDRICAL GRINDING . . . . . FROM *0 degrees to 45 degrees*



The Fitchburg Adjustable "Type C" Angular Head Grinding Machine is another single application of the Fitchburg Standard Bowgage Wheelhead Unit. The "Type C" is designed to handle a wide range, and a number of types of jobs. In finding ways to cut your grinding time and costs it will pay to consider what this machine can do.

This newest of Fitchburg plain cylindrical grinders has a Standard Wheelhead Unit mounted so that it may be located to grind from 0 degrees up to a 45-degree angle. Previously angular head grinding machines have been equipped with fixed heads for single purpose grinding. The Bowgage head on the Fitchburg "Type C" is adjustable and can be swivelled to various positions for standard plain grinding, thus providing greater grinding utility. The head goes through a completely automatic cycle — rapid traverse to work, correct feed, grinding dwell and rapid return. The workhead is adjustable for various lengths of work and the work spindle can be equipped for single or variable work speeds. The trueing device is hand operated and mounted on the work table.

The Fitchburg "Type C" grinder is designed to meet war time production speed and maintain highest efficiency. Ease of operation is assured by centralized controls. In every detail it meets all the requirements of plain cylindrical and taper grinding — in large or small lots of work, with assured accuracy and fine finish, at low cost.

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FITCHBURG, MASSACHUSETTS, U. S. A.

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Do you know gages and their proper use?

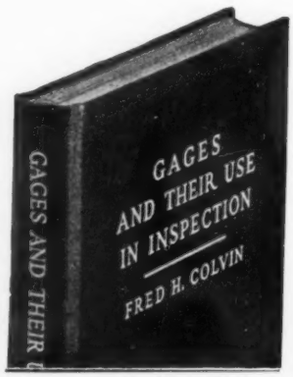
What is the proper kind of gage for a specific type of work? How are gages constructed? How are they used? Fred Colvin, out of his wide and intimate experience, has set down in a practical, workable manual the essential facts about gages of all types—how they are made, how to use them, which types are best for specific jobs, how to use them in inspection work.

Gages and Their Use in Inspection

By Fred H. Colvin
Editor Emeritus, *American Machinist*
157 pages, 5½x8, 71 illustrations, $1.50

This book describes all types of gages, from calipers, Verniers, Micrometers, Measuring Blocks, etc., up to the latest electrolimit gages. Tolerances, limits, and allowances are carefully defined and explained, and many practical kinks and suggestions on inspection are included.

Here is what the book covers—



1. Gages and How They Are Used
2. Measuring Instruments In Common Use
3. Types of Gage
4. Gage Tolerances and Gage Wear
5. Gage Blocks and Dial Gages
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Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

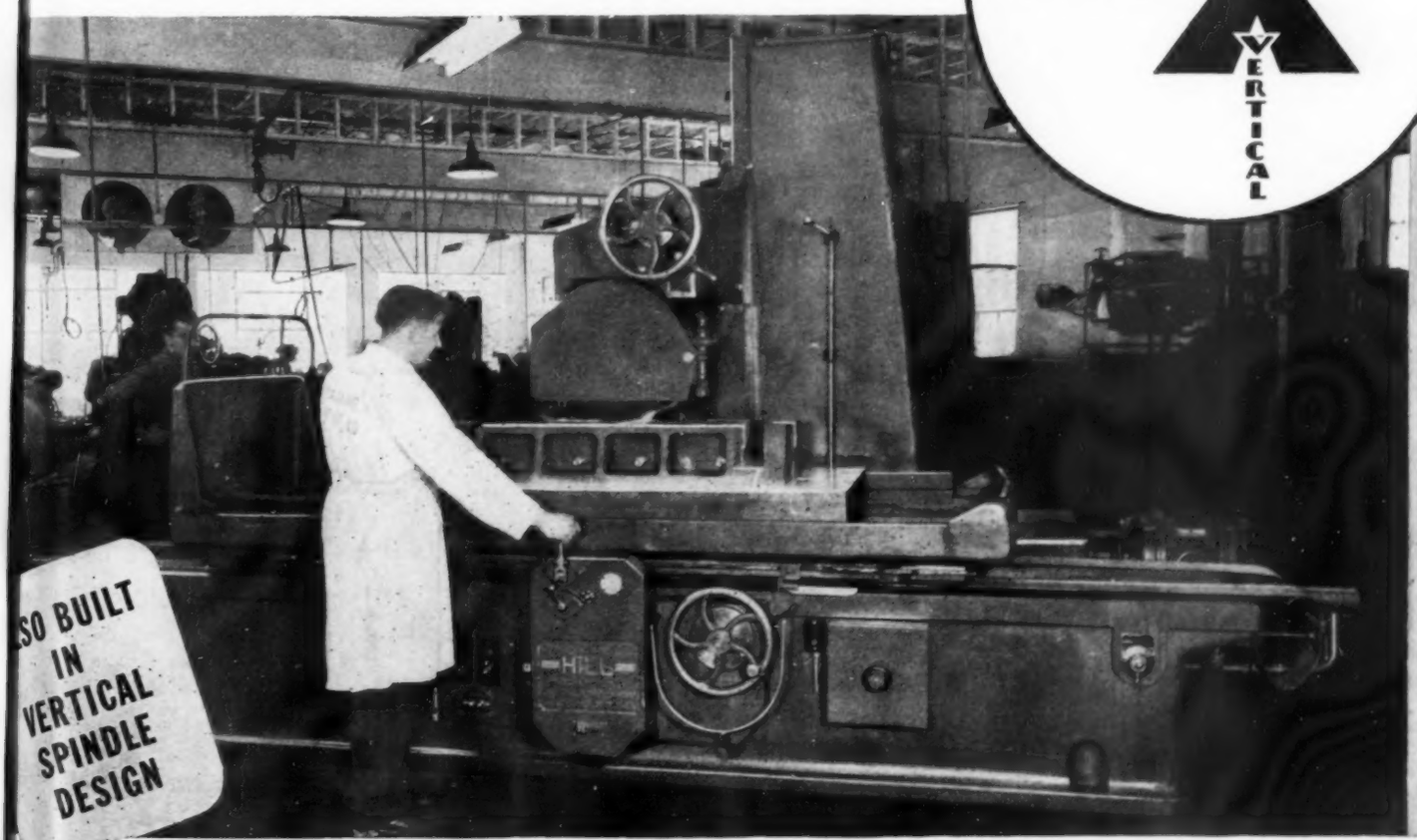
It will do the same for you

Customer's comment on his new HILL "Open Side" Horizontal Spindle Hydraulic Surface Grinder . . . .

"An easily controlled, very accurate machine of rugged construction that saves many hours of scraping on large jigs, fixtures, surface plates, machine bases, die shoes, and general miscellaneous work."

HILL "Open Side" Precision Surface Grinders are built in table widths of 18", 24", 30" and 36". Table lengths range from 5 to 20 feet.

A 30"x 30"x 72" HILL "Open Side" Horizontal Spindle Hydraulic Surface Grinder... with 30"x 72" HILL Rectangular Magnetic Chuck.

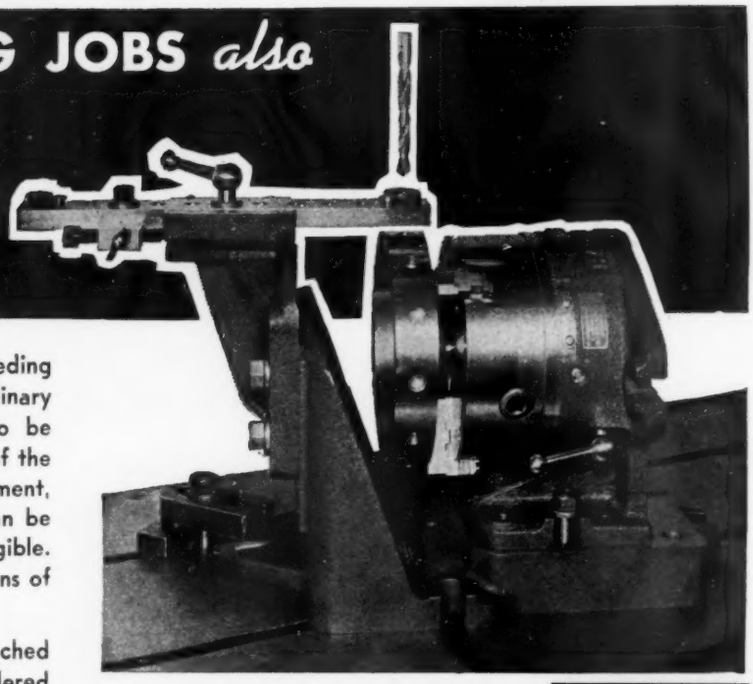


SO BUILT IN VERTICAL SPINDLE DESIGN

The HILL ACME CO.

A consolidation of two nationally known, fifty year old manufacturers:—The Hill Clutch Machine & Foundry Company... and The Acme Machinery Company
6400 BREAKWATER AVE., CLEVELAND, OHIO

RADIAL DRILLING JOBS *also can be speeded up on the* HARTFORD SUPER-SPACER



In addition to its utility as a means of speeding indexing on milling, slotting, planing and ordinary drilling, the Hartford Super-Spacer can also be adapted for use in radial drilling by the use of the Radial Drilling Attachment. With this attachment, variations in diameter and length of holes can be easily handled. Set-up time is practically negligible. Extreme accuracy is assured under all conditions of use and operation.

The Radial Drilling Attachment is easily attached to any Hartford Super-Spacer and can be ordered at any time. It can be depended on to speed up radial drilling production work.

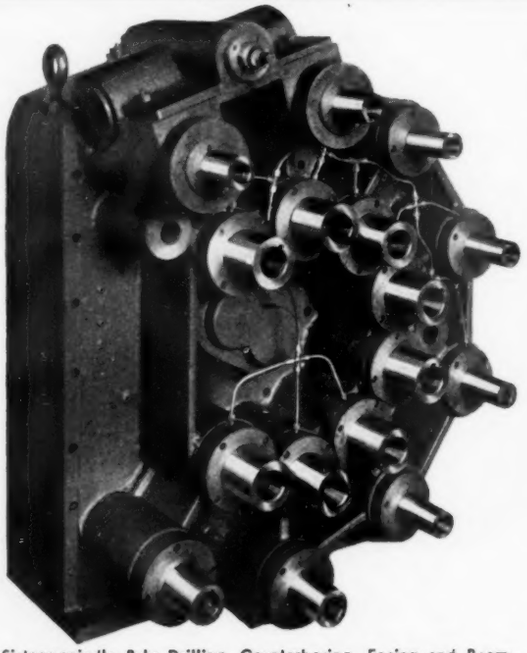
FULL INFORMATION AVAILABLE PROMPTLY ON REQUEST

THE HARTFORD SPECIAL MACHINERY CO.,
Hartford, Connecticut

Buhr DRILL HEADS SIMILAR TO THIS ONE,

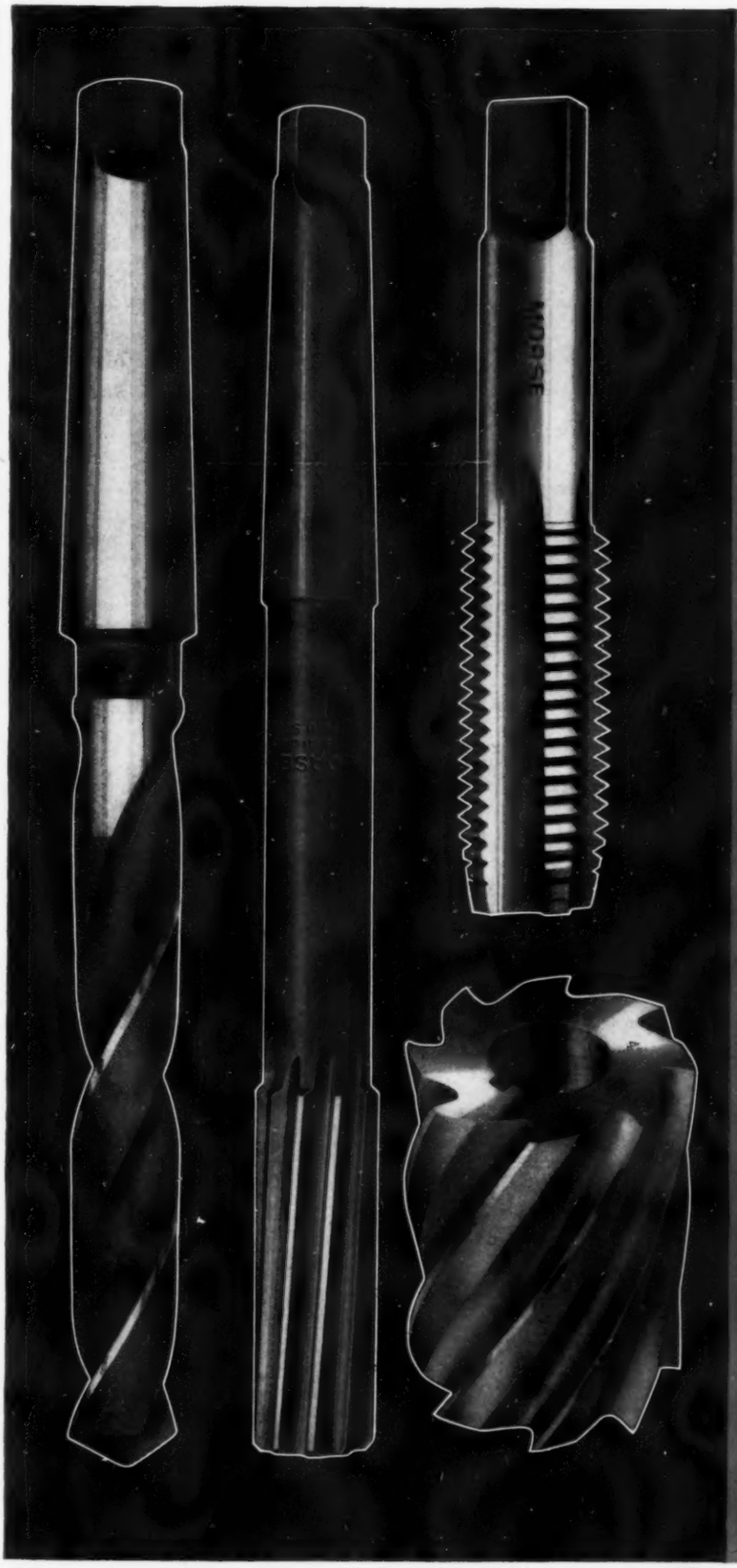
ARE SPEEDING PRODUCTION IN VITAL WAR PLANTS

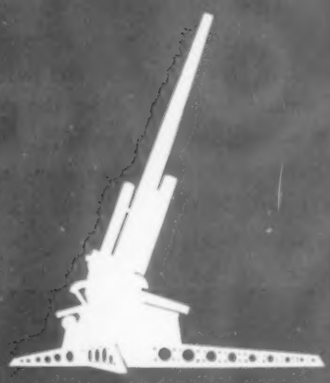
Here is but one example of the specialized engineering incorporated in BUHR-designed drill heads, now being used in the production of aircraft and armament. Want similar applications, so as to speed your work? Then send us your blueprints . . . . we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.



Sixteen-spindle Buhr Drilling, Counterboring, Facing and Reaming Head, designed for the left-hand head of a 2-way Machine. Vertical adjustment. Two top spindles are accelerated to give three times the feed of the other spindles. Oil pump provides positive lubrication.

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICH.
Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment





RAISE YOUR SIGHTS!

The output of your machines is determined by the quality of the cutting tools you use.

MORSE THERE IS A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

Bodine COMPENSATES for LABOR SHORTAGE

with

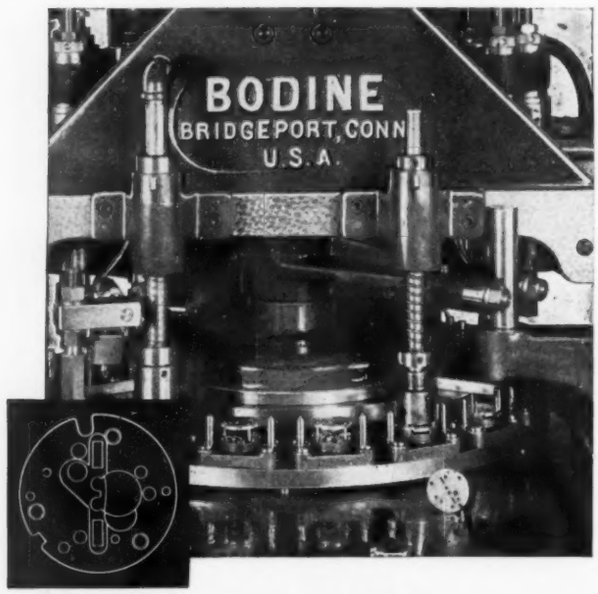
MULTIPLE OPERATIONS

Check the figures on a Bodine machine production sheet. You'll immediately see the value of this automatic multi-operation principle to plants where labor shortage exists.

An indexing dial carries the work to a succession of accurately located spindles where parts are finished to closest tolerances by tools held either vertically, horizontally or inverted . . . or in all three positions.

The operator merely places the part in a self-clamping dial fixture and the rest of the cycle is automatic, even to the ejection of the work.

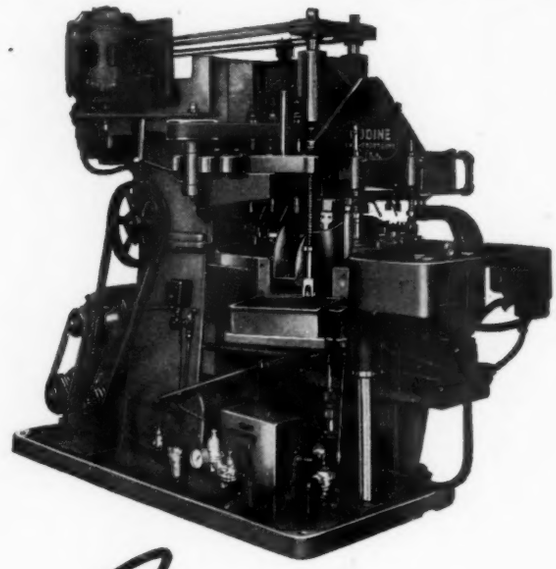
Thus more and faster operations are crowded into valuable hours, with maximum production from a one-man machine.



TOOLING SET-UP FOR ORDNANCE PART

The Bodine 42-30, shown above, in a close-up of the dial, is tooled to drill accurately spaced holes in a delicate ordnance component. As the dial is automatically indexed to a station, each fixture is accurately positioned from master pins, by hardened bushings in the drill jigs. Seven holes are drilled (sizes .5mm to 2.8mm dia.) with tolerance for center distance .0004".

Bodine engineers will help you to solve production problems . . . from your drawings or sample parts.



DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

Bodine machines are made in 6 sizes, some of which may be tooled to perform four operations at one stroke of the machine . . . in some instances finishing 2 parts to a single cycle of the indexing dial. Electric inspection gauges frequently control the accuracy of finished parts, while automatic protective devices prevent damage to tools, machine or product, as well as insuring safety to the operator.

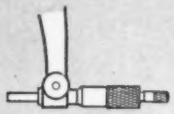
Milling fixtures are completely adjustable in all directions, so that a change in the dial adapts the machine for many combinations of tooling set-ups.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

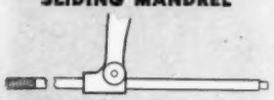
D&T TUBULAR MICROMETERS AND STANDARDS

STANDARD MICROMETER CONSTRUCTION



Micrometer is of standard design, held firmly in threaded frame by a lock nut. One inch adjustment.

ACCURATE, RIGID SLIDING MANDREL



Extra accuracy and rigidity are assured in the sliding bar by the lock screw design—a slight turn holds the mandrel securely in place. No slot is needed — this weak spot in the collar is eliminated. Mandrel is 10" in length.

LIGHT, SENSITIVE FRAME

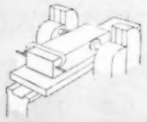
Hollow construction permits lightness and sensitivity to touch, while insulating the micrometer against body heat.

STANDARDS ACCURATE TO ± .001"

Companion tools to the D&T micrometers are the D&T standards. Hardened tool steel ends and a seamless, steel tube protect the original accuracy of these standards, while the hollow, air-filled space with fibre grips absorb body heat and keeps expansion and contraction to a satisfactory minimum.

The deep throat of this crescent-shaped D&T Bow Micrometer is ideal for measuring large, cylindrical pieces.

The D&T Bar Micrometer is designed for use on large flat work, especially in places where clearance will not permit the use of the bow.



FOR TOOL ROOM *Accuracy* ON LARGE DIAMETERS

Your big problem of maintaining accurate measurements on large diameter work can be easily and quickly solved by D&T micrometers and standards. All of the precision of the conventional micrometer is here — in giant size — to check tolerances to .001" on work up to 168" diameter. The feather-touch lightness of these precision instruments makes it easy to detect the slightest inaccuracy.

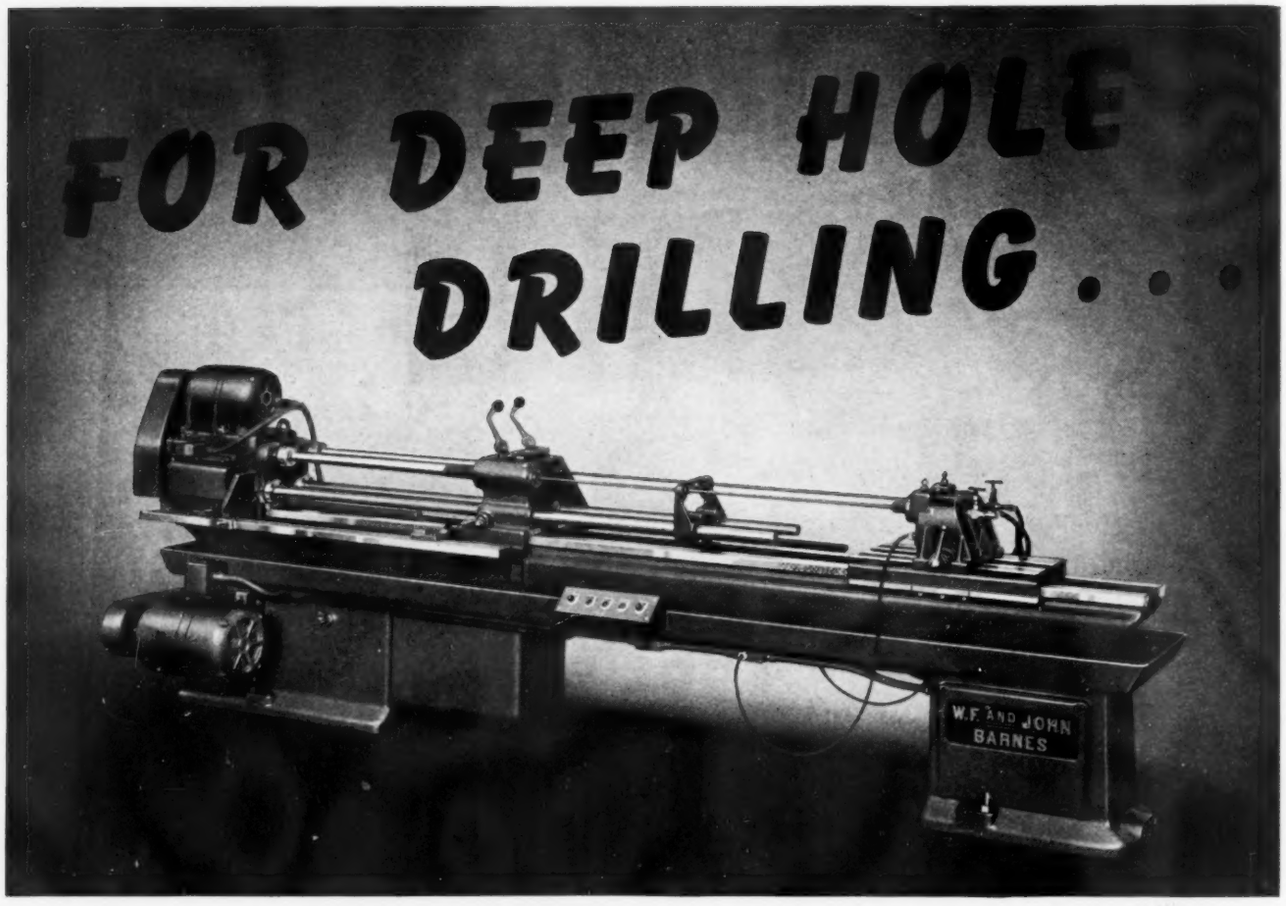
Durably constructed for long, hard service, D&T micrometers have a light, rigid frame of hollow, cold-drawn steel, with drop-forged ends welded on to hold the sliding mandrel and micrometer head. Available in crescent or bar types in 45 different sizes, 0" to 168".

Used daily in plants manufacturing heavy machinery and industrial equipment such as turbines, locomotives, freight cars, rolls—indispensable in steel mills, engine plants, paper mills, arsenals, navy yards and armament plants.

Write for a copy of the new bulletin describing D&T Tubular Micrometers in greater detail.

DAVIS & THOMPSON CO. • Milwaukee, Wisconsin, U. S. A.

D&T *Tubular Micrometers*



W. F. and JOHN BARNES 410 RIFLE DRILLER

THIS two-spindle Rifle Driller was designed primarily for the drilling of rifle barrels up to .50 calibre. But—it is not limited to rifle barrels *only*. It is suited to deep hole drilling of diametrically balanced parts.

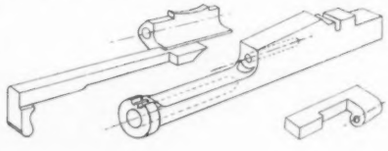
It is furnished in three standard sizes with strokes of 24″ — 36″ — and 48″. Spindle speed may be varied from 1000 r.p.m. to 2000 r.p.m. through sheave and vee-belt changes.

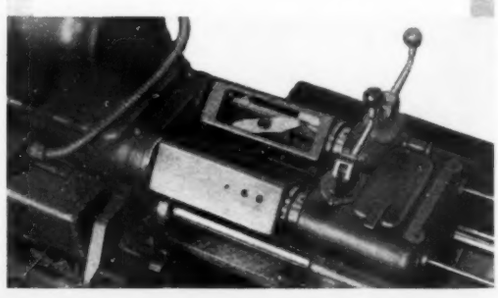
Controlled hydraulic actuation from a self-contained unit of our own design imparts a positive feed to the barrels. Drills feed through the last fraction of the cut, instead of breaking through.

The tool holders, provided with torque overload protectors are mounted on a common saddle and can be moved on individual ways to accommodate variations in tool length.

FOR NON-SYMMETRICAL PARTS

● You can readily equip a W. F. and John Barnes 410 Rifle Driller to drill non-symmetrical parts through the use of cradle-type fixtures, or by counterbalancing the chucks. A few typical parts are illustrated below.





FREE DESCRIPTIVE FOLDER . . .

Write today for free folder describing the 410 Rifle Driller. If you have non-symmetrical parts to drill, send us your part print and we will quote you on a 410 machine and furnish a production estimate.

W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

There's a real "KNOW HOW" in CORRECT BROACH DESIGN

...and DETROIT BROACH ENGINEERS HAVE THE NECESSARY KNOWLEDGE AND EXPERIENCE TO HELP YOU

All the men you see here are experts in designing broaches and broach accessories. That's their only job.

When these men design broaches for you, you save time. The job goes straight from the drawing-board into production. There's no waste in high speed steel, because the broach is designed *exactly* for the job for which it is intended. You save money, because these men have the "know-how" to do the job right the first time. And there's a decided saving in man-hours, as Detroit Broach engineers can do the work faster, more efficiently.

All *you* have to do is send us a print of the part you want broached—and tell us the type of machine on which the broach is to be used. These men will go right to work.

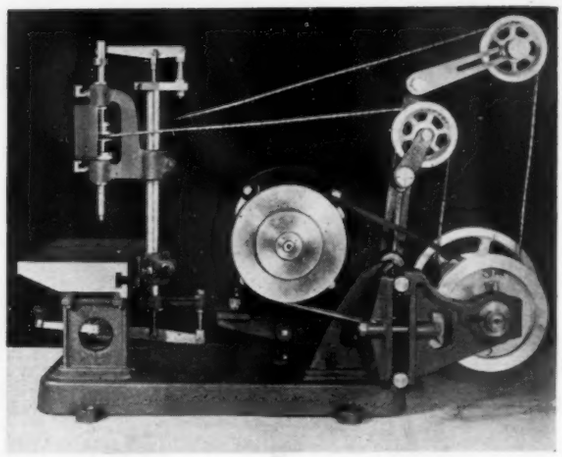
Remember, *correct broach design* means greater efficiency—faster production—lower costs. Let Detroit Broach engineers help you at every stage of your broaching operations—starting with broach *design*.

DETROIT BROACH COMPANY

20201 SHERWOOD AVENUE • DETROIT, MICHIGAN

NEW-- *Super sensitive*

HIGH SPEED DRILL PRESS —SPEEDS UP TO 23,000 R.P.M.



The NEW Lord & Davis Super Sensitive Drill Press offers convenient finger-tip control, precision, balanced construction, and speeds up to 23000 R.P.M.—all vitally important for drilling holes from 1/16" down to .004" (or smaller) in diameter.

The sensitivity is attained by balancing the spindle by means of the vertical component of the belt tension. This accurately transmits the "feel" of even the tiniest drills to the finger-tip control. Drill breakage is thus reduced to a minimum.

Machines with one, two, three, or four spindles are available. Mail the coupon today for details!

Please send me complete details on the Super Sensitive Drill Press.

Name ..... *Title* .....

Company .....

Street .....

City ..... *State* .....

A.M.

EDWARD BLAKE COMPANY
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

J-B TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS

THE NEW NO. 3 HIGH SPEED WIGGLESWORTH SMALL PARTS MILLER

featuring AUXILIARY POWER FEED

High production capacity available for a wide variety of jobs . . .

Small parts production can be greatly stepped up and high quality and accuracy maintained through the use of this new fast, versatile milling machine.

While retaining features ordinarily found in hand millers, the Wigglesworth adds AUXILIARY POWER LONGITUDINAL FEED—a feature which vastly increases the utility of the machine as well as the quality of the work it is capable of turning out. This feature has been developed through a simple rugged design which is powerful and dependable. Steady smooth feed is assured under all conditions.

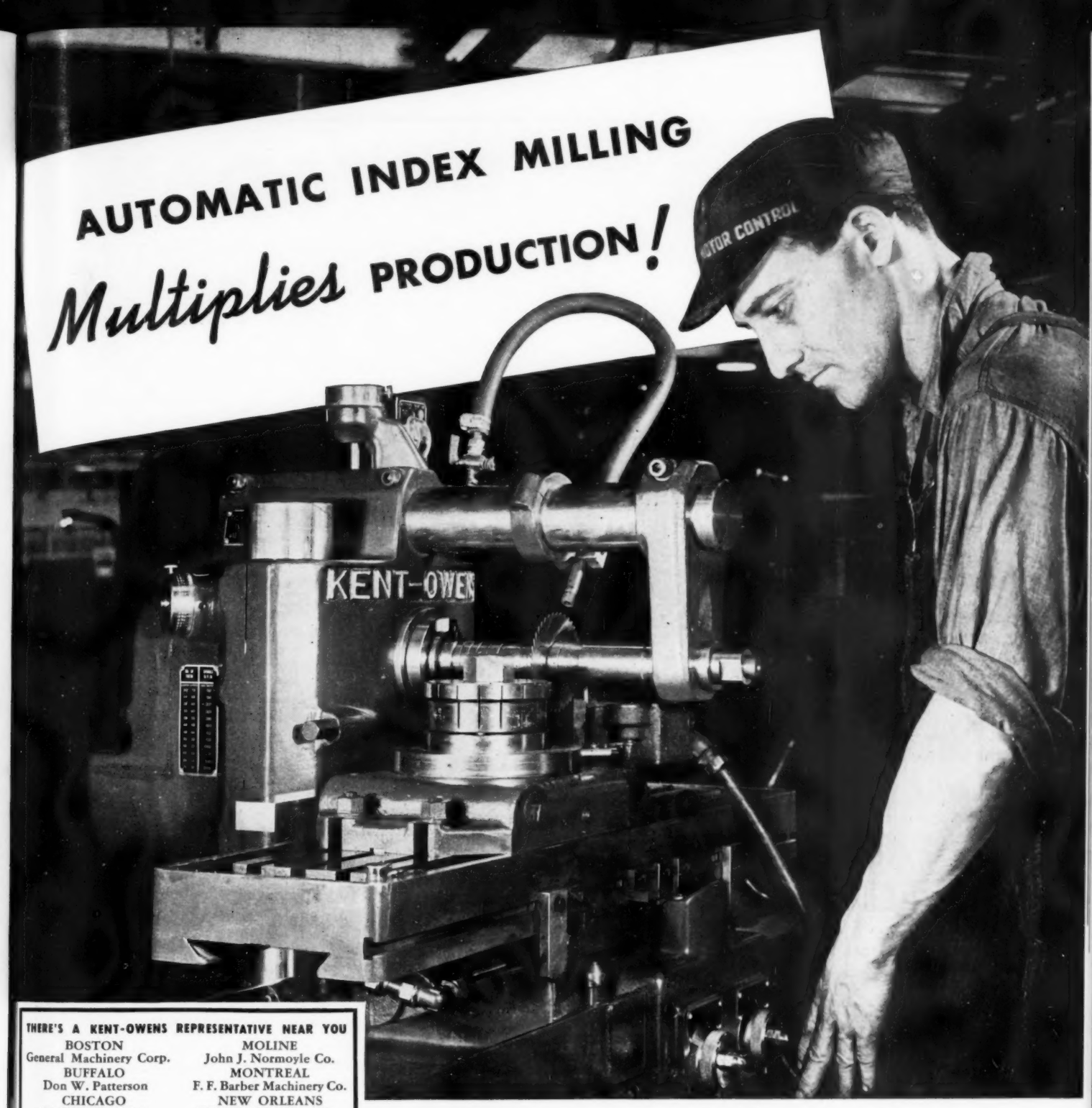
Other advanced features contributing to the performance and high quality work of this machine include: planetary feed gear mechanism, hardened and ground spindle mounted on two Timken precision roller bearings, knee of heavy box section, one-piece box-section column and motor in base drive. Can be equipped with Coolant Pump and Tank, and also Single "T" Slot Production Table.

Table working surface 7" x 20"	Vertical motion to knee—10"
Lever feed to table—10"	Speeds (6) from 150 to 800 R.P.M.
Crank or power feed table—5¼"	#40 Standard Taper Spindle

SEND AT ONCE FOR COMPLETE DETAILS

WIGGLESWORTH MACHINE TOOL CO., 195 Bent St., Cambridge, Mass.

AUTOMATIC INDEX MILLING *Multiplies* PRODUCTION!



THERE'S A KENT-OWENS REPRESENTATIVE NEAR YOU

BOSTON
General Machinery Corp.

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Don W. Patterson

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DALLAS
Hamilton-Huster Machinery Co.

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LOS ANGELES
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Harron, Richard, & McCone

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F. F. Barber Machinery Co.

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SYRACUSE
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TORONTO
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WALKERVILLE
F. F. Barber Machinery Co.

● Shop men everywhere are calling on Kent-Owens for Automatic Index Milling Equipment.

Kent-Owens has had wide experience in engineering a great variety of fixtures for this type of work.

If you have operations that lend themselves to automatic index milling, contact Kent-Owens to *multiply your production.*

Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS *for Milling Machines*

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

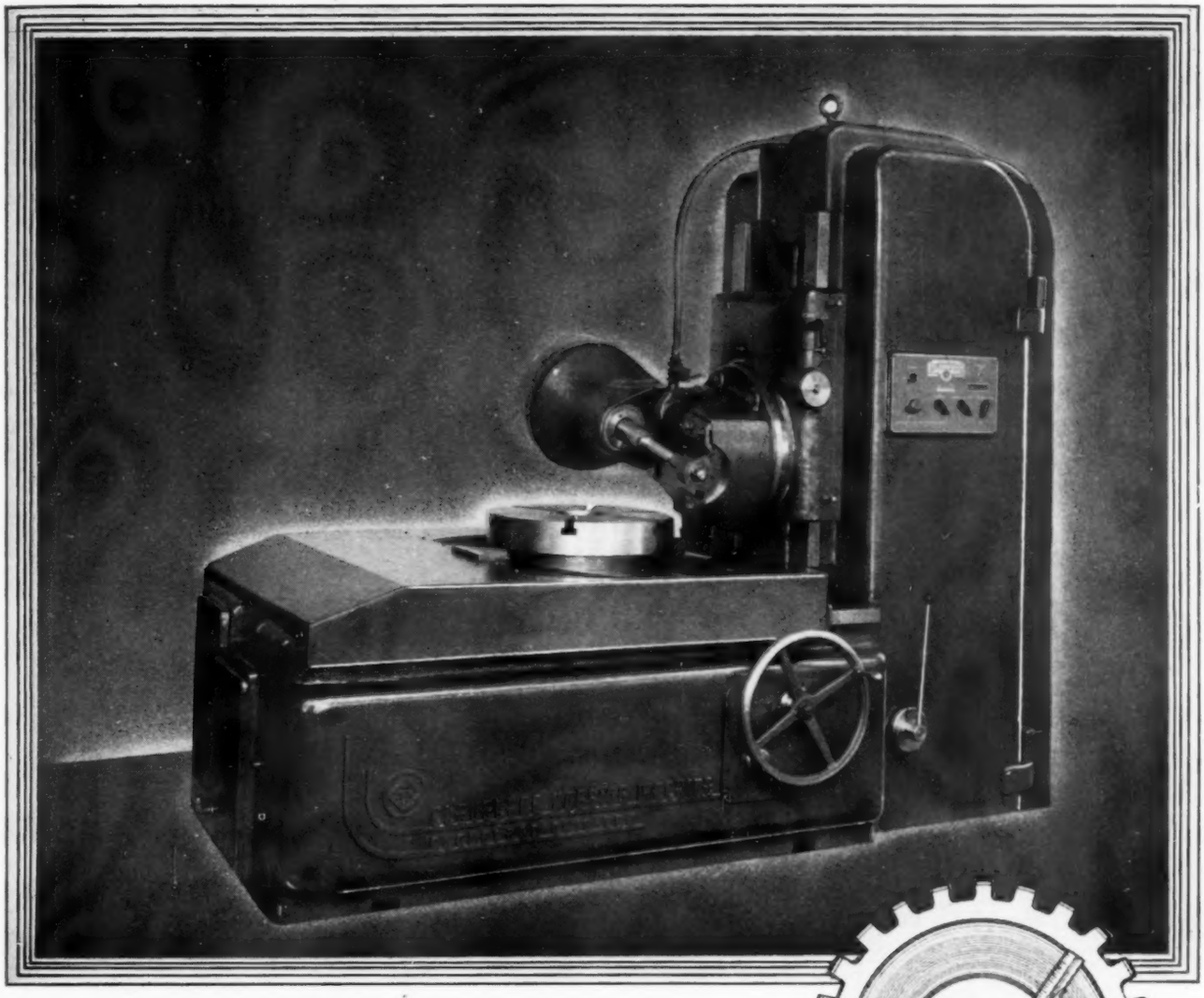
If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

Save With

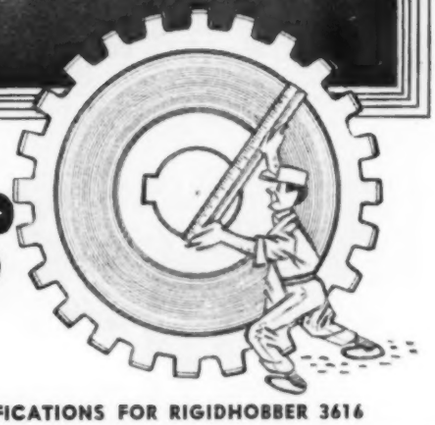
War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST



LARGER GEARS



The latest Cleveland Rigidhobber, Model 3616 has been developed to meet modern industries' demands for the larger gears that transmit power into the tanks, the heavy duty trucks, guns, airplane propellers and marine installations of today.

Model 3616 is not limited to the cutting of large gears, versatility is the keynote of this model, boasting the adaptability of cutting a gear as small as 6" in diameter.

If your gear cutting problem is a small or large one, please write for information.

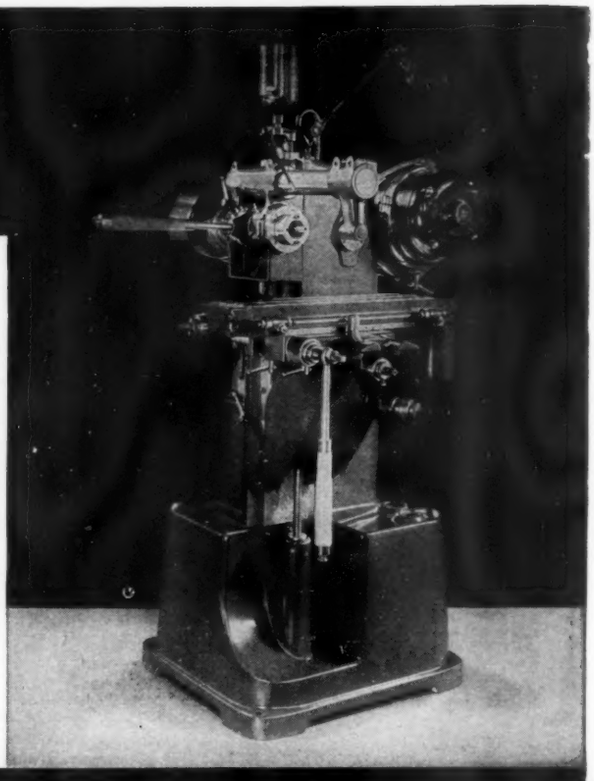
SPECIFICATIONS FOR RIGIDHOBBER 3616

Maximum Diameter Spur Gears	36"
Maximum Diameter Helical Gears	27"
Min. Center Line Work & Hob Arbors	3"
Maximum Hob Diameter	8"
Diameter Work Table	24"
Diameter Index Gear	26"
Rated Max. Dia. Pitch	3"
Floor Space, inc. door swing	54" x 160"
Weight	18,000#

36" DIAMETER 16" TRAVEL 20" LONG

THE CLEVELAND HOBBING MACHINE CO.
CLEVELAND · OHIO

★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST



. . . with the

NICHOLS HAND MILLING MACHINE

Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

. . . capacity: longitudinal feed 10"; traverse feed 7".

» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

For accurate small part production

For long trouble-free life

For low original investment

Vernon

TOPS THEM ALL!

IDEAL FOR TODAY'S DEFENSE NEEDS—Ample capacity and a wide variety of standard accessories quickly adapt the Vernon No. 0 Mill to hundreds of applications.

STURDY, COMPACT, POWERFUL—One h.p. motor gives the Vernon the ability to "walk" through the tough jobs as well as today's light alloys.

LOW COST—Vernons are priced so low they have paid for themselves in 30 days.

See the Vernon at your dealer's, conveniently located in all important industrial areas.

Bulletins are available featuring the Vernon Vertical Mill & Jig Borer, Vernon No. 0 Mill, Vernon 11" Shaper and Vernon 12" Shaper. WRITE TODAY!

MACHINERY MANUFACTURING COMPANY
1215 EAST 51 ST., VERNON LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

Accurate, Speedy and Economical thread cutting

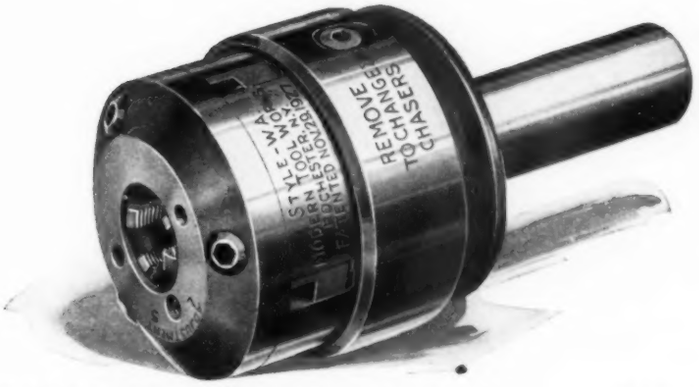
with

MODERN ROTARY TYPE SELF-OPENING DIE HEADS

Least number of parts.

Simplest construction.

Hardened and ground throughout.



"WA" Die Head—Ring type, for opening and closing

"WB" Die Head—Trigger Trip Type

Cuts close to shoulder threads without special chasers.

Easily adjusted for Thread size.

Requires no springs to operate movement of chasers.

Made in four sizes having capacity for cutting
Straight Threads from 1/8" to 1 1/4"
Straight or Taper Pipe Threads from 1/8" to 3/4"

MODERN TOOL WORKS

Division of Consolidated Machine Tool Corporation
ROCHESTER, NEW YORK

FREE-

TO USERS OF H&G DIE HEADS

Instruction
BULLETINS COVERING

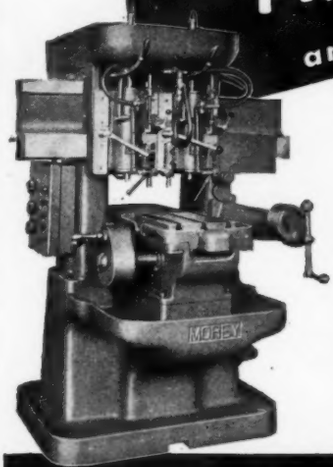
The Care of General Purpose Die Heads
Hobbed Chasers
Grinding Data on Insert Chasers
Style MM (Rotary) Insert Chaser Die Head
Style DMS Insert Chaser Die Heads
Style DM Insert Chaser Die Heads
Style TM Taper Cutting Insert Chaser Die Head
Styles SAM and SAMA Solid Adjustable Insert Chaser Die Heads
Model 1C Threading Machine

In addition, as a part of our service we publish "DIE HEADLINES"—an informative bulletin packed with practical thread cutting suggestions for improving production, quality and volume. Give description of machine and size and style of H & G Die Heads used with your request.

The Eastern Machine Screw Corp.
20-40 Barclay Street **New Haven, Conn.**

Preloaded Precision Bearings for Spindles

MOREY 12M
HIGH-SPEED VERTICAL PROFILER and MILLER



Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street **New York, N. Y.**

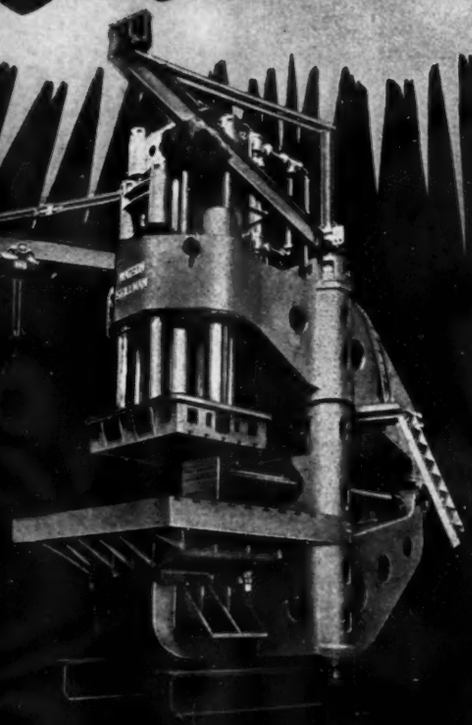
Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities.

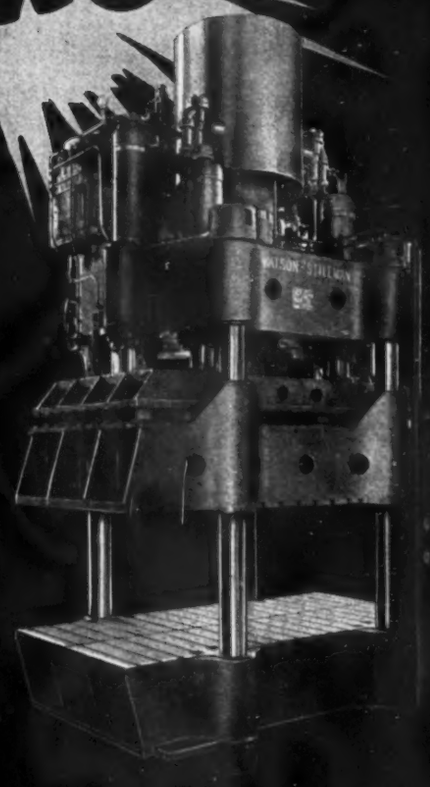
STURDIMATIC
TOOL COMPANY
5214 THIRD AVE. DETROIT, MICH.

Their Job today is AXIS BUSTING

W-S PRESS HELPS MACHINE-GUNNERS SHOOT STRAIGHT



METAL WORKING MAMMOTH HELPS SHIP PROGRAMS



800-TON W-S PRESS . . . FOR BETTER BOMBERS

These giant W-S Presses "hit 'em hydraulically" by land, sea and air

Barrels for lead-spitting machine guns... flange plates for storm-riding fighting ships . . . metal parts for devastation-dealing bombers . . . that's the kind of production Uncle Sam asks for and *gets* today. It's the type of vital work that Watson-Stillman Presses are turning out—in the day shifts and night shifts of America's Axis-busting war plants.

This wide range of service illustrates the scope of the W-S line of hydraulic equipment. It emphasizes not only the versatility of many individual types of presses, but also the resourcefulness and "know-how" which are built up year after year in the course of a near-century of hydraulic experience.

Working closely with plant engineers has long been the privilege of Watson-Stillman. In the adaptation of existing equipment to new needs or in the design of new machines for special purposes, many such engineers have found this service of practical help. Feel free to consult Watson-Stillman on any technical problem involving hydraulic equipment.

★ ★ ★ ★

To bring your reference library up to date, ask for your free copy of the recently published Bulletin 120-A, a publication packed with information, tables, formulae, etc. A letter on your business stationery brings you this piece of engineering literature. Simply address Watson-Stillman Co., Roselle, N. J.

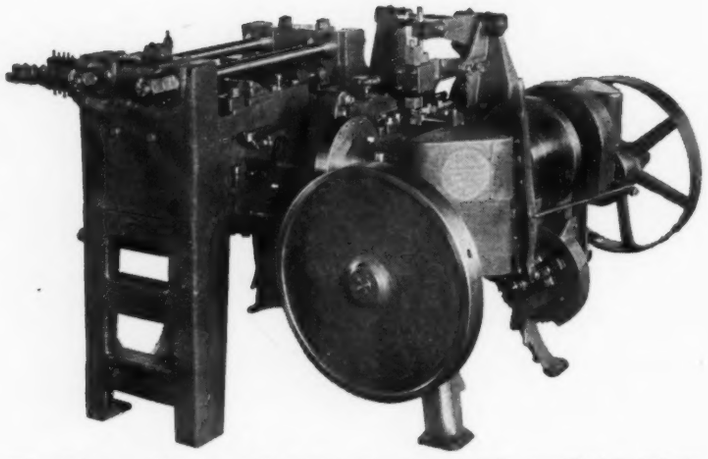
2718

WATSON-STILLMAN

Engineers and Manufacturers of Hydraulic Machinery and Equipment — Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings.

HANDLE YOUR SWAGING, STAMPING, PIERCING, BLANKING and FORMING of COILED METAL

ON THE **NEW NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINES**



These Nilson machines are built in two sizes and are fully described in Bulletin No. 90, available promptly on request.

. . . for fast, heavy duty work

An outstanding feature of these combination power press and four slide machines is the powerful, silent action of the main press slide which is operated by crank motion through toggle or knuckle joints. Overhead stay rods contribute to the tremendous strength and rigidity of this machine.

Other features include simple and easy changing of accessible and removable die set, open construction of forming slides and tool adjustments made without interference.

Nilson's more than 30-year experience in the design, development and manufacture of special, high production automatic machinery is available to assist you in producing any special machines you may require. Consult our engineers and be assured of a comprehensive service.

THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn.*

CENTRAL
FOR MORE THAN A QUARTER CENTURY SPECIALISTS IN FINE MICROMETERS
CERTIFIED ACCURACY
Developed and Perfected by America's Only Makers of Micrometers Exclusively
All sizes up to 6 inches available with graduations by thousandths of an inch.
★
All sizes up to 4 inches are also available with graduations by ten thousandths of an inch.
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THE CENTRAL TOOL CO.
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RHODE ISLAND
MICROMETERS OF CERTIFIED ACCURACY
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Certified Accuracy
MICROMETER
MADE BY THE CENTRAL TOOL CO. AUBURN, R.I. U.S.A.
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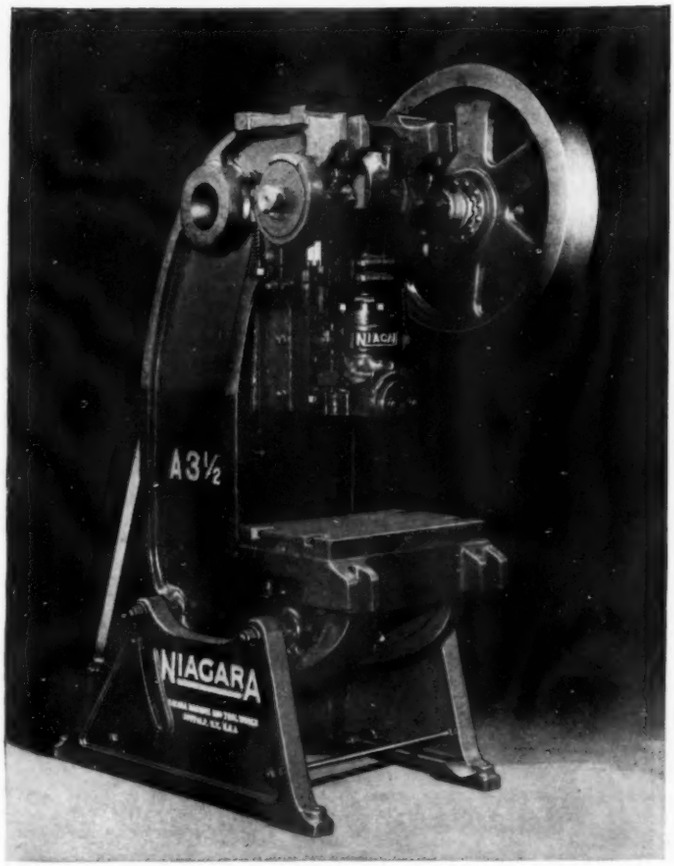
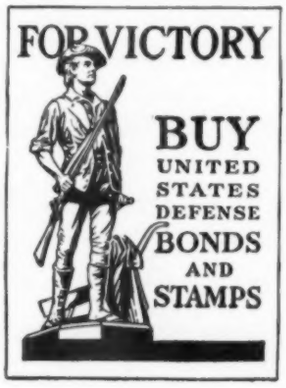
MICROMETERS OF CERTIFIED ACCURACY
AUBURN RHODE ISLAND



The production lines of American industry are behind the battle lines of the United Nations. Batteries of Niagara Presses and Shears are speeding up production for America's foremost manufacturers of war materiel.

High output, convenient operation, reliability that reduces shut downs to a minimum are performance factors resulting from Niagara design.

Niagara Presses and Shears are built in a complete range of well graduated sizes. Write for Bulletins. Niagara Machine & Tool Works, Buffalo, N. Y. District Offices: Cleveland, Detroit, New York.



TOMKINS-JOHNSON

Air Powered

RIVITOR

Air squeeze action plus automatic feed riveting for aircraft production.

It's fast—1600 riveted joints per hour with no manual rivet handling. This is an average figure. Increased or lowered production depends on the ease with which the work can be handled.

Write for Bulletin RP-1 to The Tomkins-Johnson Co., 615 N. Mechanic St., Jackson, Michigan

TOMKINS-JOHNSON

One of numerous cartridge clips produced complete per stroke on Dieing Machines, the above is for caliber .303 rifle turned out at record-breaking high production.

We offer experienced counsel regarding Munitions Stampings

Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.

INCLUDING BROACHING

Airplane fuselage hinge of duralumin produced complete per stroke on the Dieing Machine in continuous strip to high precision limits.

Airplane strut seat of .031" brass produced complete one per stroke at new high rate.

For several years before Pearl Harbor, the unique Dieing Machine was turning out munitions stampings at record-breaking rates. Today they are called upon to produce the vast majority of machine gun belt links, as well as a wide and growing variety of parts and operations vital to the war effort. Replacing 5 to 10 conventional presses, the Dieing Machine produces the most intricate parts, complete per stroke, to precision of .0002" when required, at speeds up to 600 s. p. m., with capacities from 10 tons to 300 tons. Counsel based upon our wide experience is yours for the asking: cheerfully and promptly!

Request Catalog 42

COMPLETE PER STROKE . . . INTRICATE STAMPINGS AND ASSEMBLY OPERATIONS

STAMPINGS

- Machine gun belt links
- Mechanical time and contact fuse parts
- Rifle components
- Cartridge clips, or rifle chargers
- Gas mask stampings
- Ammunition stampings
- Bomb components
- Shell parts
- Detonator stampings
- Airplane instrument engine and fuselage parts

OPERATIONS

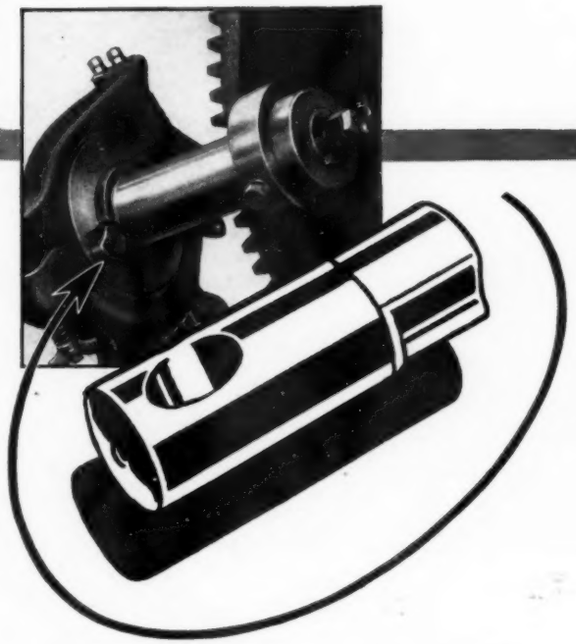
- Bullet assembling
- Primer inserting
- Automatic time and contact fuse assemblies

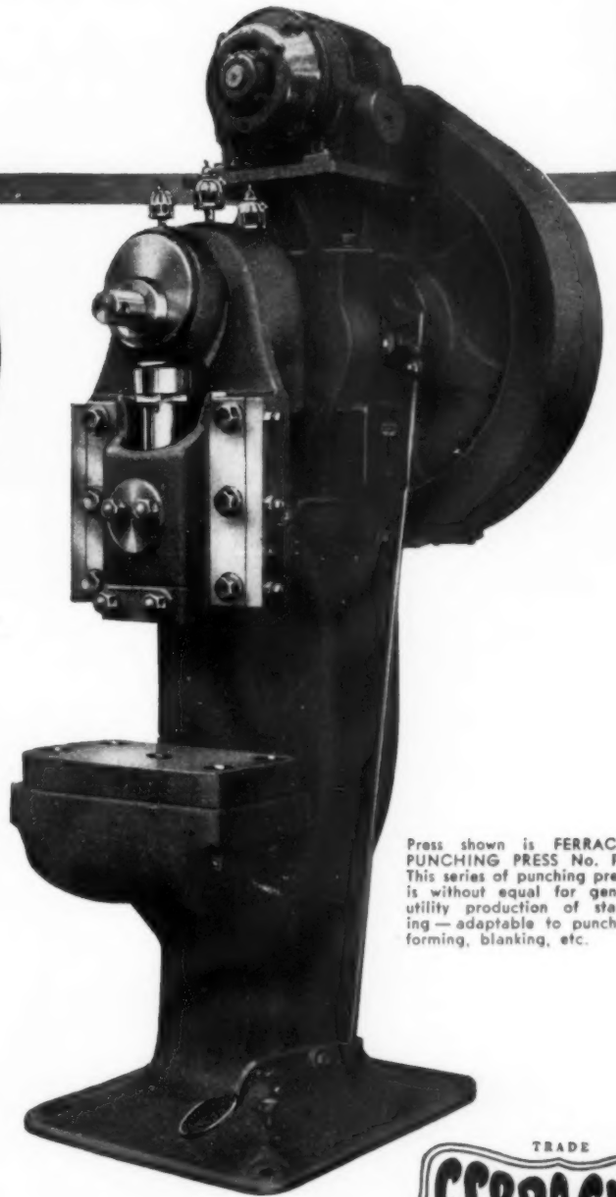
THE HENRY & WRIGHT MFG. CO.
487 Windsor St. Hartford, Conn.

Henry & Wright Dieing Machines

FERRACUTE'S *PLUS VALUES*
are now paying off
in PRODUCTION

Once they may have seemed like salesman's talking points—those "plus values" of FERRACUTE presses—but now that American war industry approaches the pay-off hour, they are paying off in PRODUCTION. FERRACUTE's **extra** engineering details, **extra** standards of strength of materials, **extra** safety factors, **extra** guards against breakdowns, **extra** ease of adaptability—all are triply important now that something EXTRA is essential for continuous, uninterrupted war production that is punishing to men and machines. And sometimes a little **extra** knowledge will help improve the performance of even FERRACUTE presses.





WATCH DOG OF PRODUCTION

The Driving Dog on the FERRACUTE Automatic Pin Clutch is a watch dog of production, designed to prevent costly breakdowns and long shutdowns for repairs. Made of Alloy Steel, carefully heat-treated, the Dog or Clutch Slide will give you years of service under normal conditions. It is designed, however, to break when the press is dangerously overloaded—thus preventing more serious damage to press, dies, or to operator. The Slide is easily replaced since it is round and can, in an emergency, be made in any machine shop.

The FERRACUTE Automatic Pin Clutch is typical of the "plus values" engineered into FERRACUTE presses. It is safe, sure, quickly adaptable, low in maintenance delays.

Press shown is FERRACUTE PUNCHING PRESS No. P 4. This series of punching presses is without equal for general utility production of stamping — adaptable to punching, forming, blanking, etc.

FERRACUTE'S
MACHINE COMPANY
Bridgeton, N. J. **U. S. A.**

TRADE FERRACUTE MARK

PUT YOUR COLD METAL SAWING ON A LOW COST, HIGH PRODUCTION BASIS.. *with this* **NEW** PORTER-McLEOD MACHINE

Especially designed for stepping-up speed of cutting stock from 3 inches up, the Porter-McLeod 8" Cold Metal Sawing Machine is a money saver that quickly pays for itself.

Driven by a 5 H. P. enclosed motor and conveniently controlled by push button, this new machine makes big savings on general work or on production work involving single or multiple units. Because of its capacity and upper feed it is possible to "nest" economical quantities of bars and shapes so that several pieces can be cut at one time. The standard 3 inch feed of this machine can be increased for cutting brass and non-ferrous metals.

Features which make this machine particularly advantageous for fast accurate production of larger sizes of stock include: support of blade close up to its rim and pulling of blade through the cut, a design which prevents buckling of saw, eliminates weaving, insures maintenance of accuracy and straight cuts; feed is by friction disc which insures against blade breakage especially when hard spots are encountered in the stock being cut.

Get all the details of this new machine by writing *NOW* for descriptive bulletin.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

Now more than ever you need this help for Training Tool and Die Makers

Widely used by many companies and trade schools throughout the U. S. it meets urgent need for a complete, up-to-date text for training new men, "refreshing" older men, or trouble shooting in the tool room. The shortage of tool and die makers must be met fast by men who know the "whys" and "hows". This book gives them both and more. It shows how to select tool steel; how to make tools; how to avoid trouble; how to improve tool performance. Read on the right what others say about this modern text.

TOOL STEEL SIMPLIFIED
By Frank R. Palmer
A Vice-President of
The Carpenter Steel Company
315 pages — 205 illustrations
$1.00 postpaid in U. S. A. Elsewhere $3.50

Low price of $1.00 per copy makes it economical for training use. Elementary enough to meet the urgent need for a good text for apprentice training. Practical enough to be helpful in advancing the skilled tool maker. Contains hundreds of practical suggestions that can be quickly applied in daily work to get improved tool performance. Send coupon at right for a copy of "Tool Steel Simplified."

Read What Others Say:

. . . Consider it one of the very finest books that our local schools of vocational and adult education might use in training of apprentices in machine trades.
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. . . Valuable textbook for apprentices and journeymen, and an equally valuable handbook for tool designers and others concerned with the use of tool steel.
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. . . Simple and easy to read. Contains useful information which commends it to technical men, semi-technical men, and men in the shops who want to improve their ability to make the best use of tools.
Prof. Bradley Stoughton
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Lehigh University

. . . have read and re-read the book. Became absorbed in finding out and learning so many things I never knew before. Chapter 17 on quenching is worth the price of the book . . . will need 45 copies for classroom use.
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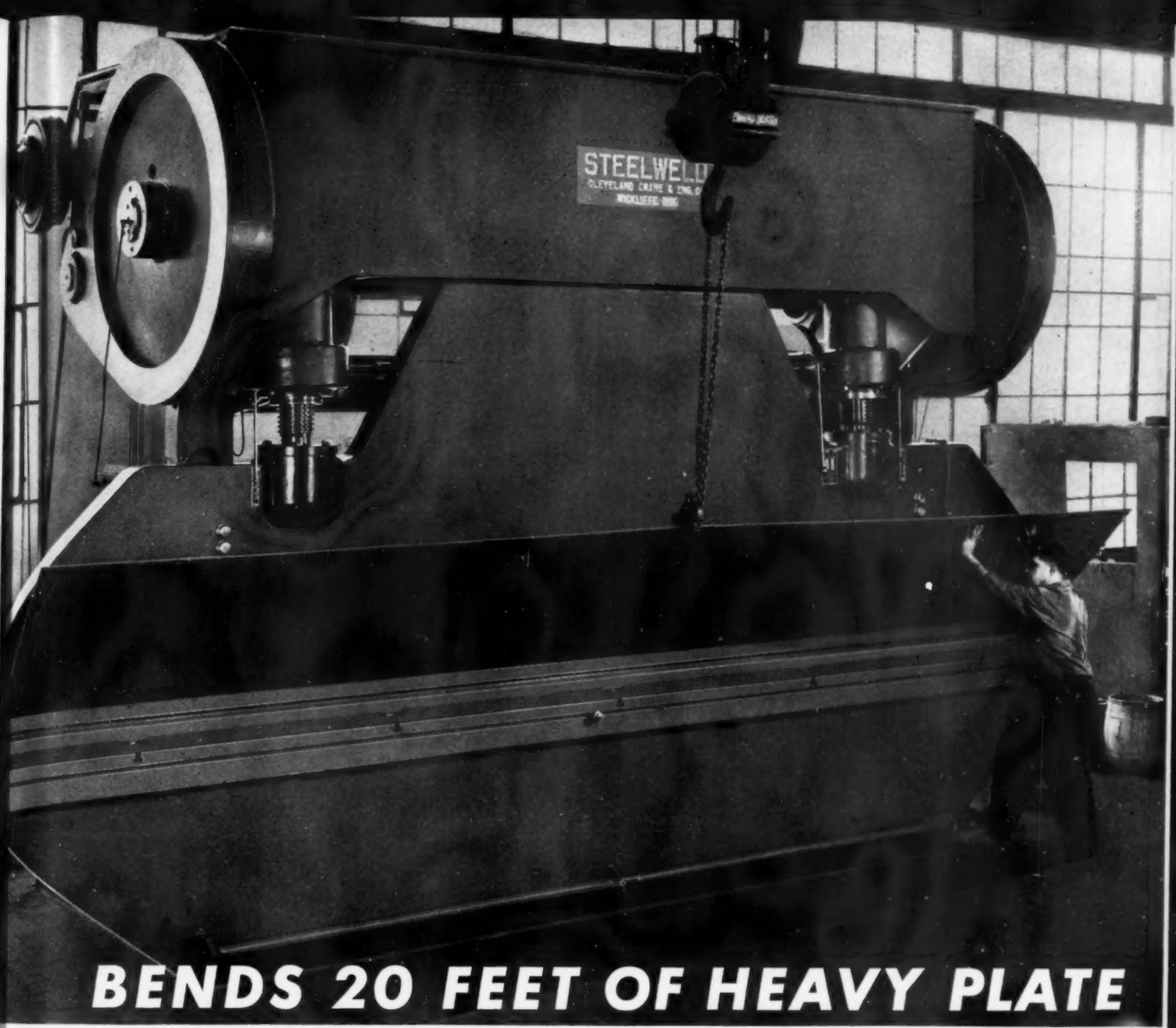
Worcester Boys' Trade School
Worcester, Mass.

SEND *Now*

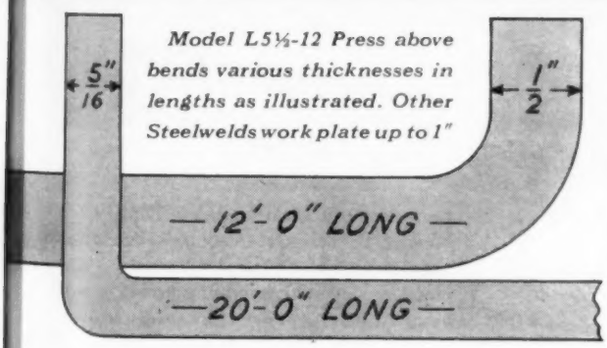
The Carpenter Steel Company
Reading, Pa. Dept. 1K.

YES, I WANT TO SPEED UP TRAINING WORK. Please send me postpaid your convenient handbook "Tool Steel Simplified." I enclose $1.00 ($3.50 outside the U.S.A.) in full payment.

NAME .....
COMPANY .....
Firm Name Must Be Given
ADDRESS .....
CITY ..... STATE .....



BENDS 20 FEET OF HEAVY PLATE



Model L5½-12 Press above bends various thicknesses in lengths as illustrated. Other Steelwelds work plate up to 1"

How long does it take you to weld or rivet two $\frac{5}{16}$" x 20'-0" steel plates together at right angles? How long if you were making a U-shaped or Z-shaped item?

For work of this sort you will find a Steelweld Press a most useful tool. It will cut time and cost to a small fraction. You will save even when you only have occasional odd jobs. For production runs the reduction in time is tremendous. And you will save rivets and angles or welding rod and power too.

Bending is just one of the various types of work you can do on a Steelweld Press.

CATALOG No. 2002 gives complete construction and engineering details. Mail request for free copy on your company letterhead.

GET THIS BOOK!

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
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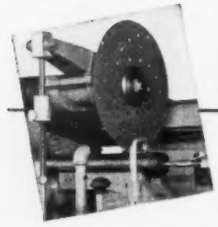
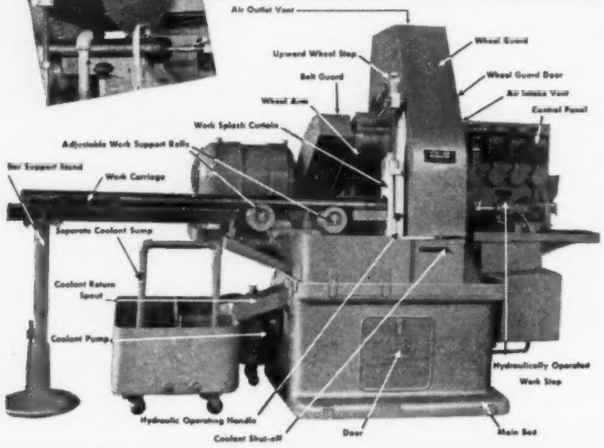
NEW! THE Campbell CUTALATOR



FOR ABRASIVE CUTTING OF TUBULAR SECTIONS TO 4½" DIAMETER... AND ANY SOLID STOCK TO 3½" DIAMETER — *WITH TOP EFFICIENCY*



You get accurate set-up because of new, hydraulic work stop. Your production speed is increased by the controlled, rapid approach of the wheel to the work—and by the predetermined rate of cutting.

Short arc of wheel contact, due to the oscillating-rotating motion of the wheel, gives you economical cuts.

Accuracy and economy are added to by adjustable coolant wings.

Finally, the new Campbell Cutalator is engineered to make certain that you get these advantages in your shop—the operations centering on the multiple positioned lever which hydraulically (a) positions stock automatically (b) clamps work and starts coolant flow (c) controls wheel approach and (d) starts predetermined-speed cutting.

● The New **CAMPBELL CUTALATOR** is another example of how Campbell has engineered cutting machines to fit today's production—another reason for their current use on aircraft, aircraft engines, propellers; and for the production of trucks, cars, tanks, guns, bombs, shells, small arms ammunition, field telephones, etc.

● You will be under no obligation if you have a Campbell engineer study your cutting problems. Yet his suggestions may lead to important economies and increase in production.

ANDREW C. CAMPBELL DIVISION
Bridgeport, Connecticut

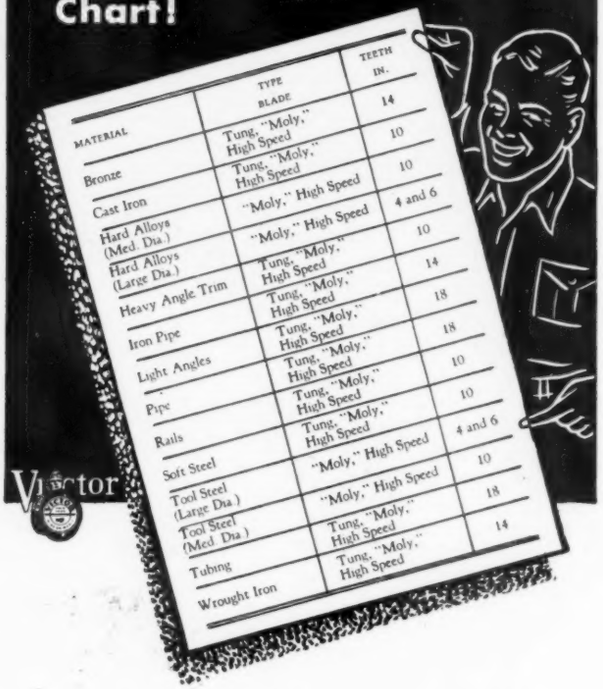
This new booklet gives the interesting details of what you can expect of the new **CAMPBELL CUTALATOR**. Write for a copy.

Campbell ABRASIVE CUTTING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

For faster sawing with fewer blades..

Clip and keep this handy VICTOR Power Hack Saw Blade Selection Chart!



MATERIAL	TYPE BLADE	TEETH IN.
Bronze	Tung. "Moly," High Speed	14
Cast Iron	Tung. "Moly," High Speed	10
Hard Alloys (Med. Dia.)	"Moly," High Speed	10
Hard Alloys (Large Dia.)	"Moly," High Speed	4 and 6
Heavy Angle Trim	Tung. "Moly," High Speed	10
Iron Pipe	Tung. "Moly," High Speed	14
Light Angles	Tung. "Moly," High Speed	18
Pipe	Tung. "Moly," High Speed	18
Rails	Tung. "Moly," High Speed	10
Soft Steel	Tung. "Moly," High Speed	10
Tool Steel (Large Dia.)	"Moly," High Speed	4 and 6
Tool Steel (Med. Dia.)	"Moly," High Speed	10
Tubing	Tung. "Moly," High Speed	18
Wrought Iron	Tung. "Moly," High Speed	14

Follow these recommendations to speed work, save blades. And to get tip-top results, always be sure the blade you select is a VICTOR Blade.

To learn More!

write for the illustrated VICTOR booklet, "Metal Cutting" — 20 pages of facts and helpful tips on metal sawing with hand and power blades, frames and band saws. Ideal to train new men. Helpful for veterans too.

VICTOR SAW WORKS, INC.
MIDDLETOWN, N. Y.

Please send me____copies of "Metal Cutting"—free.

Name_____

Address_____

2845

Performance

Cutting SAE 105 shell stock, after piercing. The compensating, hydraulic feed safeguards the blade while cutting this 485 Brinell, hard, forged tube.

PEERLESS SAWS SAVE TIME, METAL, BLADES

Today's Wartime savings and profits, invested in War Savings Bonds, will speed the Victory. And, the dollars you lend to your government will establish a fund for the new machines you'll need to "tool up" for peacetime operations.

Peerless Saws help you buy more bonds by saving time, metal and blades on your sawing operations.

The Peerless Four-Sided Saw-Frame and Backing-Plate Blade-Support speed up metal cutting and the thin, cool-running, straight cutting Peerless Blade removes as little as 1/16" of the stock. Blade life is lengthened . . . cutting time is improved . . . and metal is conserved.

Consider the Peerless 3-way saving for your metal cutting jobs. Send in your test samples. We'll cut them and show you how.

PEERLESS MACHINE COMPANY • RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-942, Racine, Wisconsin

Mail cutting time estimate for.....

☐ Mail catalog on Hydraulic type Saw for High Production Cutting
☐ Mail catalog covering Vertical type used for Die Block Work
☐ Mail catalog on Mechanical type Saw for production cutting
☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City.....State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

...for inspecting gages as well as for parts production inspection...use the SCHERR COMPARITOL

RANGE OF SCALE .004"
GRADUATED TO .0001"
MEASURING RANGE 0-6" STANDARD
0-8" HEAVY DUTY

Accurate, sensitive and dependable enough to be used by many of American's premier gage makers for inspection of *the gages they make*, the COMPARITOL is also rugged and sturdy enough to be used daily in shops for inspection of thousands of mass-produced parts.

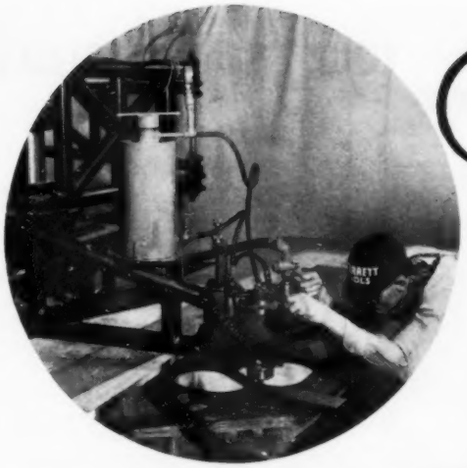
In one plant, 60 COMPARITOLS are paired with batteries of grinders for inspection of centerless ground work *as the work goes through production*, without loss of time or material.

Write today for folder explaining why the Comparitol belongs in your shop

EXCLUSIVE LEVER MECHANISM

The Measuring Head holds the operating mechanism which consists of only 2 moving parts—the vertical spindle with feeler point and the vertical lever and pointer assembly. The new patented knife-edge bearing construction (illustrated here in simple form) is largely responsible for the COMPARITOL'S extreme accuracy, reliability and long life. This exclusive design is featured by a V-notch block of two-piece construction which eliminates any fillet or radius at the apex. As a result, a degree of accuracy is attained which is higher than that ordinarily available in precision instruments.

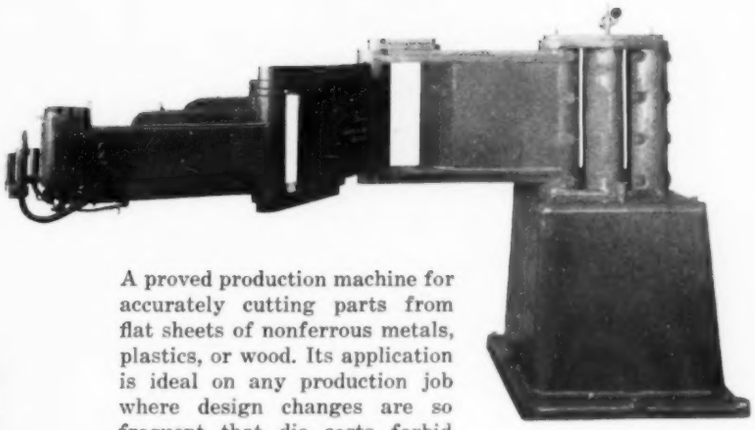
GEORGE SCHERR COMPANY
124 Lafayette Street
NEW YORK



'Way Back in 1936 A. D.

When in 1936 an Onsrud air turbine portable router was mounted on a tubular jointed arm, it marked the birth of a fundamentally new machine tool. In the few years since then, Onsrud engineers have developed this machine and its scope; to make it one of the aircraft industry's major machine tools for high speed production.

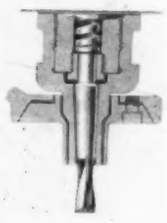
The Onsrud Radial Arm Router *Today*



A proved production machine for accurately cutting parts from flat sheets of nonferrous metals, plastics, or wood. Its application is ideal on any production job where design changes are so frequent that die costs forbid the use of presses. Turning at high RPM, the router bit leaves a mirror-smooth finish wherever it cuts. Production capacities are amazingly high. Feeds may be as fast as an operator can move the router head. Sheets may be stacked to a maximum depth of ¾" so that several parts may be routed at one time.

The Onsrud A-4-R Radial Arm Router illustrated above has a maximum arm reach of 114", for work over a 4' x 12' table. The router bit turns at 15,000 RPM. Motor bearings are lubricated by Onsrud patent Metered Mist, a centrifugal force feed lubrication system, especially designed for high RPM operation. In addition to the 114" machine, an 84" arm Radial Arm Router is also available. Machines may be had with single or double arms. Radial arm drills are also offered.

Bulletin giving complete information on all Onsrud Radial Arm Routers and Drills available upon request.



ANOTHER PATENT ONSRUD FEATURE

The Onsrud Taper Chuck holds taper router bit in perfect vertical alignment. Reduces overhang to only ⅞". Eliminates vibration and resultant cutting, inaccuracies and bit breakage.

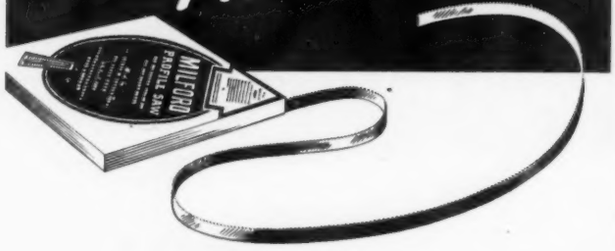
ONSRUD MACHINE WORKS, INC.

3921 Palmer Street • Chicago, Illinois • U. S. A.

Sales Offices in all Principal Cities

Onsrud AIR TURBINE and HIGH CYCLE TOOLS and MACHINES
ROUTING · DRILLING · SHAPING · GRINDING · MILLING

Yes, sir . . . we're making prompt deliveries on MILFORD PROFILE SAW★



★ The answer to top production on ALL contour-sawing, jig and band saw machines.

To take care of huge war production orders, as well as a greatly enlarged industrial demand, we've increased our production facilities ten-fold. Stocks are good in practically all sizes, and we are making quick deliveries.

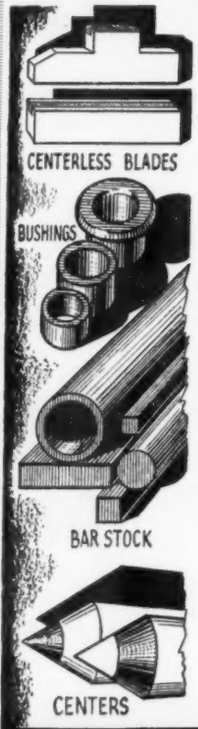
That means that you can get the best, and get it promptly. MILFORD PROFILE SAW is made by the world's largest, most experienced producer of metal cutting band saw.

Have you a band saw machine that has not yet been adapted to Profile Sawing? If so, write us for directions and a free sample. Include specifications of the machine and the cutting job you'd like to do on it.

Carried in stock by Mill Supply Distributors in every locality.

THE HENRY G. THOMPSON & SON COMPANY
NEW HAVEN, CONNECTICUT
Also makers of MILFORD REZISTOR HACKSAW BLADES

SOLVE "YOUR" WEAR PROBLEMS
with
TALIDE
TUNGSTEN CARBIDE
WEAR • METAL



CENTERLESS GRINDER BLADES give 10-30 times longer life, reduce replacement costs, and do not mark or score work when Talide-Tipped with Tungsten Carbide strips.

DRILL JIG BUSHINGS, Sizing Bushings, and Gages made of Solid Talide maintain their size 25-50 times longer. They take a mirror-finish and are not affected by changes in room temperature.

BAR STOCK of Solid Tungsten Carbide is available *in any size or length* and in all practical shapes such as strips, rods, bars, tubes and rings.

LATHE & GRINDER CENTERS tipped with Talide outlast hardened steel centers by 50 times, and permit faster speeds without danger of burning or galling.

Send blueprints or detailed information for engineering data and prices

METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

Keeping **WAR PRODUCTION** *Moving*

DESMOND
DRESSERS and CUTTERS

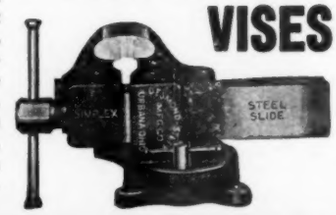
★

DESMOND-dressed grinding wheels cut faster . . . last longer . . . keep production on the move. In plants throughout the country, you'll find these superior tools doing their part. With the only *complete* line of Dressers and Cutters, *DESMOND can meet your needs*—all types and sizes. Get them from your distributor—write for his name.

★

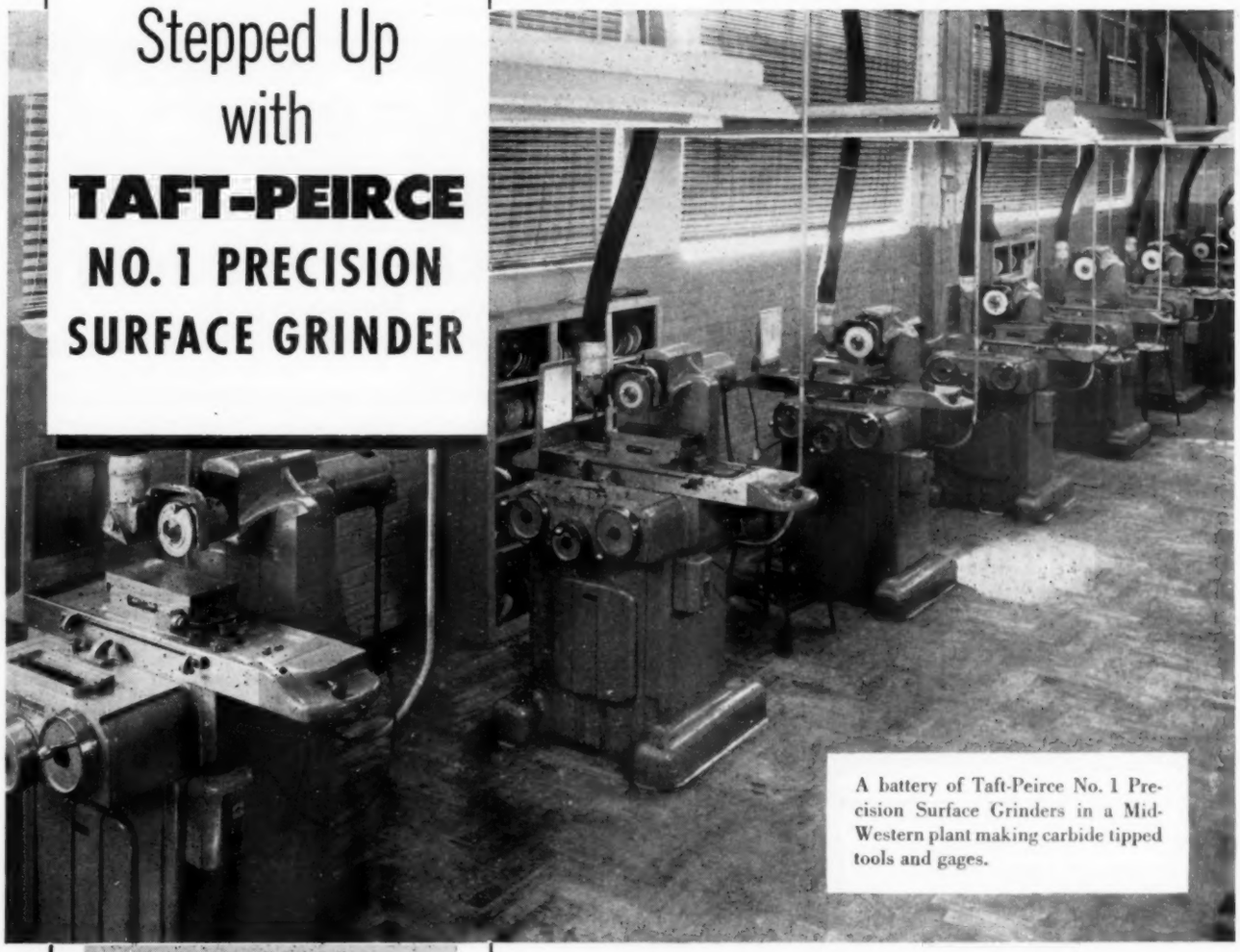
SIMPLEX SLIDE STEEL VISES

Built to take it! That's the SIMPLEX Steel Slide VISE. On production jobs that mean 24-hour-a-day service, the qualities of the exclusive SIMPLEX Steel Slide mean greater strength . . . longer life. In many sizes and types — machinists', welders', pipe, etc. There's a distributor in your territory—write for his name!

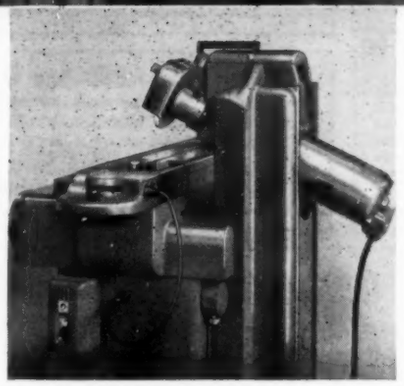


The DESMOND-STEPHAN Mfg. Co.
URBANA, OHIO
The Canadian Desmond-Stephan Manufacturing Company, Hamilton, Ont.

Quality and Output Stepped Up with TAFT-PEIRCE NO. 1 PRECISION SURFACE GRINDER



A battery of Taft-Peirce No. 1 Precision Surface Grinders in a Mid-Western plant making carbide tipped tools and gages.



Exclusive Tilting Wheelhead. Machine is readily adapted for angle and shoulder work.

Almost without effort, operators can produce surfaces which are flat to extremely close tolerances, without slow and complex tool set-ups. Even difficult angle and shoulder work is made readily possible by the tilting wheelhead which is quickly and accurately adjustable. This entirely different design offers you the opportunity to raise your present ceilings of precision and output for the surface grinding of gages, small tools and parts. For illustrated bulletin, write to:

THE TAFT-PEIRCE MFG. COMPANY

WOONSOCKET RHODE ISLAND

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

GEST ENGINEERING & EQUIPMENT CO.
Ordnance and Defense Plant Equipment
Industrial Engineers
Jigs, Fixtures, Gages and Special Mach.
31 East, Georgia St. Indianapolis, Ind.

THE NORLIPP COMPANY
Engineers . . . Manufacturers
Sub-contract facilities for die castings and metal stampings
556 West Congress Street Chicago, Illinois

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
3908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

NEED SUBCONTRACTORS?
If you can't find the facilities or services you need advertised here, we may have the company that can help you listed in our files. Write.
CONTRACT WORK DEPARTMENT
American Machinist, 330 W. 42nd St., N.Y.C.

NEED SUB-CONTRACTS?
Investigate the possibilities offered you through the CONTRACT WORK SECTION!
For details, write
CONTRACT WORK DEPT.
American Machinist, 330W.42nd St., N.Y.C.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal
for
Medium Heavy
SPECIAL MACHINERY
CONTRACT WORK SOLICITED
ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

FORGINGS
• All types up to 6,000 lbs. Smooth Forged—Finished—Rough Turned, Hollow Bored and Heat Treated to Specifications. Crank Shafts—Shafting—Connecting Rods
BAY CITY FORGE CO.
ERIE PENNSYLVANIA

MACHINE SHOP
Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.
C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

Need steel balls for defense assemblies ?
The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.
ABBOTT BEARING BALLS

PUT YOUR IDLE CAPACITY TO WORK!

Hundreds of metal-working companies are finding profitable business today *outside* their regular lines.

You, too, can put your idle machines and equipment to good use by directing attention to them through American Machinist's CONTRACT WORK SECTION.

American Machinist's net paid circulation of over 21,000 reaches the men who need and can authorize sub-contracting.

Tell your story to these men through American Machinist's CONTRACT WORK SECTION. We will gladly send you complete information at no obligation.

CONTRACT WORK DEPARTMENT
AMERICAN MACHINIST 330 W. 42d St., New York, N. Y.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
AGERSTRAND CORPORATION
Muskegon, Michigan

BRAZING HYDROGEN ELECTRIC FURNACE PROCESS
MODERN CONTINUOUS
HIGH PRODUCTION EQUIPMENT
ALSO—BRIGHT ANNEALING
THE QUEEN CITY STEEL TREATING CO.
CINCINNATI, OHIO

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.
KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

WORK WANTED FOR
Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.
HAIDA ENGINEERING CO.
34-11 Vernon Blvd. Long Island City, N. Y.

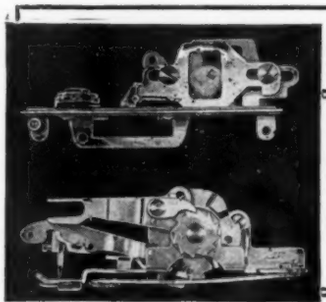
SPUR GEAR AND SPROCKET CUTTING
Have three automatic machines available—range 1" to 6' diameter.
OHMSTEDE MACHINE WORKS
897-899 N. Main St. Beaumont, Texas

Designers and Builders of Jigs, Fixtures and Small Tools.
Also Manufacturers of Automatic Turret Head for 10 inch Lathes.
Complete Details upon Request
GAS MODEL RESEARCH CO.
21 Market St. Rockville, Conn.

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service
LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria Virginia

FOR YOUR IMMEDIATE USE
5,000 MAN HRS. PER WEEK OF TOOL, DIE AND SPECIAL MACHINE DESIGNING
Est. 1930
PRODUCT ENGINEERING SERVICE
Tel. OL 3300 3301
2485 BEAUFAIT AVE. DETROIT, MICHIGAN



STAMPINGS and ASSEMBLIES

We can make long or short runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. Our manufacturing facilities also include screw machine products, tools, dies, jigs and fixtures.
Your order is assured of quality workmanship by skilled mechanics. We will furnish prompt quotations on your blueprints or samples. Write us today!
"Greater Savings with Greist"

THE GREIST MFG. CO. 546 Blake Street New Haven, Conn.

• Machines and Parts,
• Special Tools and Fixtures,
• Cam Milling, on Contract

Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., BRIDGEPORT, CONN.

GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES
BARTON MACHINE & TOOL CO.
PRECISION TOOL MAKERS
14 Taft Street Pawtucket, R. I.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., September 22nd will appear in the issue of October 1st, subject to limitations of space available

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

MECHANICAL DESIGNERS WANTED for design work on rifles and shotguns and on production equipment for same. Send complete outline of education and experience and salary wanted in first letter. Send also list of patents received, or other evidence of inventive ability. Permanent position for the right man. P-269, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED—MACHINIST FOREMAN. To establish small plant for producing screw machine parts. Must have knowledge of tooling and set-ups on single and multiple spindle automatic screw machines. Plant located eastern Pennsylvania. Apply P-313, American Machinist, 330 W. 42nd St., New York, N. Y.

PLANNING ENGINEER: Man familiar with Machine Shop operations, to take charge of planning work, supervision of drafting, and general engineering in plant of 150 employees. Location near Washington, D. C. Steady job—not a war organization, but doing defense work. Write giving full particulars. P-321, American Machinist, 330 W. 42nd St., New York, N. Y.

MACHINIST: A small shop building a light weight machine, requires a general all round machinist skilled especially on the lathe, miller and shaper. Practical experience on precision work is of greater value than any technical education. This is a splendid opportunity for advancement and particularly for permanence of position after the war. Engineering Laboratories, Inc., R.F.D. No. 1, Paterson, N. J. Pines Road near Paterson-Hamburgh Turnpike.

PLANNING AND PRODUCTION executives wanted by old established manufacturers of high grade machinery. Plant is modern and surroundings congenial and harmonious, to the right man with necessary experience and ability, this is a permanent position with unusual opportunity for advancement. Give full particulars in first letter as to experience and with whom, age, references and salary expected, correspondence confidential. P-322, American Machinist, 330 W. 42nd St., New York, N. Y.

TOOL AND DIEMAKERS on small screw machines and press tools, good living conditions. No age limit. State experience and wages expected. Location Long Island. P-323, American Machinist, 330 W. 42nd St., New York.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

EXECUTIVE with twenty-five years experience as Chief Engineer, Superintendent and Works Manager. Well versed on modern methods and equipment. Available Sept. 1st. PW-308, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or superintendent Automatic Screw Machine and small to medium precision parts, thirty years experience all phases of above types of work. Available October 1st. Salary open. PW-314, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

PLANT SUPERINTENDENT—Mechanical Engineer, at present, employed by Bakery Equipment Manufacturing Company in Connecticut. Designing and engineering all conveying and cooling systems. Held position as a Shop Superintendent for 16 years with Food processing Machinery company in New Jersey. Broad experience in Machine, Structural Steel and Sheet metal work. Four years training in Machinist trade, also carrier of diploma as Mechanical Engineer, many references from large Manufacturing Company in Switzerland. I am citizen of U. S. A. and 47 years of age. Capable of handling men and keep cost at minimum. PW-324, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED
MECHANICAL ENGINEER WITH MACHINE SHOP EXPERIENCE

One of the largest Texas oil field equipment manufacturers, whose shop is at present largely converted to war production, offers opportunity for permanent position to experienced engineer. Man between 35 and 45 years preferred. Applications should present qualifications, previous employers and salary expected, and will be kept strictly confidential.

Address: **P 319** American Machinist
520 No. Michigan Ave, Chicago, Ill.

WANTED
GAGE MAKER

Man wanted experienced in every detail in the manufacture of "Thread Gages" to eventually assume full charge of this department; state experience and salary. Connecticut location. New York interview can be arranged.

P-311, American Machinist
330 West 42nd St., New York City

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer. 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

PATENT ATTORNEY, CONSULTING ENG'R, Over twenty years engineering experience with patents. Confidential Personal Service. David Manly Heller, 134 North LaSalle, Chicago.

FOR SALE

42" PARAGON Blue Print Machine & Dryer 220 V. AC Current. Excellent condition. Priced reasonable. FS-325, American Machinist, 330 W. 42nd St., New York, N. Y.

ALFRED HERBERT LTD.
COVENTRY, ENGLAND

OFFICES AND SHOWROOMS AT — LONDON, COVENTRY, GLASGOW, MANCHESTER, BIRMINGHAM, SHEFFIELD, BRISTOL, NEWCASTLE, CALCUTTA, BOMBAY, SYDNEY, MELBOURNE, BUENOS AIRES

representing a number of leading United States makers of machine tools and workshop equipment can undertake additional agencies.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER
Est. 1924
Industrial Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

PROPOSAL
The Inland Waterways Corporation

as Agent for the Defense Plant Corporation invites proposals from machine shops for the construction of one pair, or up to twenty-one (21) pairs of triple expansion, vertical marine engines of approximately 1,000 H.P. each engine, for river towboats either with the Corporation furnishing the design and patterns or otherwise.

Communicate with J. S. Brodie, Inland Waterways Corporation, 611 Gravier Street, New Orleans, La.

INVENTORS AND DESIGNERS

We have manufacturing facilities now entirely engaged in defense work. Anticipating post-war markets, we are interested to develop for manufacturers new devices and products of non-military character. Recommended consultation with patent counsel before submittance of material. Send copies of description to be retained by us.

MICHIGAN PATENTS CORP.
Reynolds Bldg. Jackson, Mich.

FOR SALE
PATTERNS AND DETAIL DRAWINGS OF Surface Grinder

7" x 20" Mechanical Feed Excello Spindle. Sample machine has been operating successfully for two years in plant production.

BO-320, AMERICAN MACHINIST
330 W. 42nd St., New York, N. Y.

WANTED

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

POSTWAR PRODUCTS
WANTED!

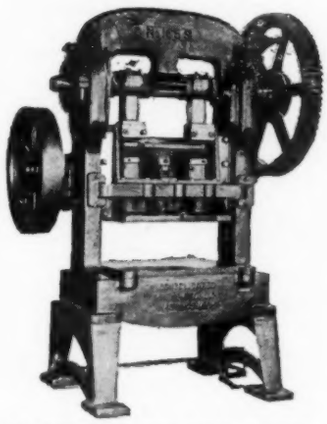
Long established, responsible manufacturing and sales organization seeks postwar products. Machinery, equipment or consumer goods. Confidential.

P. O. Box 502
Northwestern Station
DETROIT, MICHIGAN

Equipment Wanted—Page 204

FALK *for* DEPENDABILITY

PUNCH PRESSES



No. 16 Niagara Horn Press geared, 5" stroke.
3—No. 82 Niagara Foot Presses.
No. 44 V & O Horn Press geared motor drive, 2½" stroke with swinging elevating table.
No. 18, 18C, 19, 19C, 20B Bliss, O.B.I.
No. 19 Truesdale OBI.
No. 4 Adriance OBI.
No. 46 MICHIGAN OBI.
No. 4 V & O—OBI.
No. 73½ BLISS S.S. Plain flywheel.
No. 4 Bliss Back Flywheel Geared.
No. 2 BLISS Back Flywheel Plain, (6).
No. 1—Bliss Back Flywheel Plain.
No. 3R—Marquette Geared, Motor Dr.
No. 15N BLISS, arr. Geared, Motor dr. (2).
No. 41 TOLEDO HORN PRESS, arr. Motor dr.
No. 6 Waterbury Backed Geared, Open Back.
No. 25N BLISS Geared, Motor dr.; (3).
No. 1 BLISS S.S. Toggle Press.
25 Ton Henry & Wright High Speed Press, dble. roll
No. 103S BLISS GANG DIE PRESS; Roll Feed.
No. 4½ BLISS three column Forging Press with Taper
6 Ton General Flexible Press.
12 Ton Fox Flexible Press.
409 lb. Chambersburg board Drop Hammer.
1500 lb. Chambersburg Steam Hammer, single leg.
50 lb. DuPont Blacksmith Hammer.
15 lb. Bradley Upright Strap Hammer.
No. 30 BLISS ARCH PRESS, Plain.
No. 25 NIAGARA ARCH PRESS, Plain.
No. 71 Waterbury Coining Press 25 Tons.
No. 93D TOLEDO DBLE. CRANK GEARED S.S. PRESS, Welded Frame.
No. 75 Toledo Open Back Plain Flywheel Press.
No. 16 Bliss Horn Press, 3" stroke, Motor Driven.
No. 2 Niagara OBI; No. OV & O (3).
No. 3 American Can Co. OBI.
No. 53 Perkins Sprue Cutter.
No. 5 Middleditch Sprue Cutter.
No. 1—100 lb. Standard Automatic Drop Hammer.
No. 702—BLISS TRIMMING PRESSES (2) Flat.
No. 4 Waterbury open back, rigid bed, plain.
520 Ton Southwark Hydraulic with Laurie Pump.
SHERIDAN EMBOSSING PRESS, 24x36.
#7H Cleveland HORN PRESS back geared, 8" stroke with screw elevating cable. 42 tons.
#39B Bliss HORN PRESS.
#4 Bliss, double crank GEARED PRESS. 4" stroke, bed 32x28.

DRILL PRESSES—HIGH SPEED, BALL BEARING; SLIDING HEAD; SCREW EL. TABLES

5—No. 0 Barnes Drill Presses.
1—3 spindle Dwight-Slate Drill Press No. 1 M.T.
4-Spindle Foot-Burt High Speed Ball Bearing with power feed to each spindle; automatic quick return, tight and loose pulley drive; 8" overhand No. 2 Morse Taper; table workings surf, 14"x48".
1-Spindle Avey No. 3, 12" Overhang, No. 3 M.T. with Power feed; Ball Bearing.
1-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. with Power Feed; Ball Bearing.
2-Spindle Avey No. 2, 8" overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
3-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
2-Spindle, Leland Gifford No. 2 M.T. 10" Overhang. Power feed to one Spindle.
2-Spindle KERN No. 2 M.T. 8" Overhang.
2-Sp. Henry & Wright, 8" Overhang, No. 2 M.T.
1-Sp. EDLUND No. 2B, 8" Overhang, No. 2 M.T
1-SPINDLE ALLEN No. 2 M.T. 8" Overhang.
1-Spindle FOSDICK with TAPPING MECHANISM On SPINDLE No. 2 M.T. 8" Overhang.

SHAPERS & SLOTTERS

15" HENDEY, Friction Drive (5), $450 ea.
20" CINCINNATI, Geared Crank, complete.
24" Stockbridge, Geared, Crank, Heavy. Cone dr.
20"x20"x24" N-B-P SHAPER-PLANER, Motor Dr.
12" New Haven Slotter; 32" Rotary Table.
7" Rhodes combination Shaper and Slotter, belt dr.

DISC GRINDERS

Gardner No. 8—40" disc, 30" Ring Wheel, B.B. Belt Dr.
Gardner No. 4—20" Disc, 16" Ring Wheel, B.B. Belt Dr.
Badger No. 2—16" Disc, Double End, Univ. Tables, Belt.
Gardner No. 1—double end Disc, 12", B.B. belt dr.
GARDNER No. 14, Ball Bearing, double opposed, 20" discs.

20"x120" Landis Plain Cylindrical Grinder Self Cont'd, Motor drive, Serial 8034.

GRINDERS—Cylindrical

20"x120" LANDIS Self-Contained, Motor dr.
12x36" CINCINNATI Plain, Arr. Motor Dr.

DRILL GRINDERS

Models No. 510, Cap. ¼" to 3" Diameter.
Oliver Drill Grinder, Floor type, cap. 0x1½" Motor in Base.

AUTOMATIC CHUCKING MACHINES

2—No. 24 New Britain type 5 spindle.
1—No. 23 New Britain type 5 spindle.
1—J&L HARTNESS AUTOMATIC CHUCKING LATHE; motor driven, 6"x12".

BROACHING MACHINE

Cincinnati SURFACE BROACHING MACHINE, model #5-54 duplex. New in 1937. 4

PUNCH & SHEARS

WICKES COMBINATION PUNCH AND SHEAR; MOTOR DRIVEN; 1¼" thru 1" Plate; Punching end 48" throat; Shearing end 36" throat; Continuous 6"x1" Plate.
LONG & ALLSTATER No. 2—24" Throat, arr. motor dr. Capacity 1" thru 1".
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36"x16 ga. Foot Shear.
Pexto 4'x16 ft. Foot Shear.
Pittsburgh 36"x⅜" Plate Shear, no holddown.
UNITED ENGINEERING Plate Shear 42"x3/16 no holddown.
No. 216D NIAGARA RING AND CIRCLE SHEAR, Motor Dr.
No. 236 PEXTO CIRCLE SHEAR, SPD; 16 ga.
No. 132 BLISS 14 ga., 12" throat, Slitter.
No. 232 Bliss 12 ga., 18" throat, Slitter.
12'x⅜" and 6'x⅜" STAMCO MILL PACK SHEAR.
BLISS 24"x16 ga. POWER SHEAR—Perfect for Tin Plate.

COILING MACHINES

No. 1 and No. 2 SLEEPER & HARTLEY BX CABLE COILING MACHINES ⅜ and ½" cap. Last used for Speedometer cable. Complete.

KEY SEATER

No. 3½ BAKER 72"x3" Cap. immediate delivery.

HAND SCREW MACHINE

1—No. 3 Winsor Hand Screw Machine, 1¼" cap.
1—Wells 1" cap. Hand Screw Machine.
#2 BARDONS & OLIVER, Geared Friction Head. Power feed to Turret, 1" Cap. fitted with complete automatic chuck and air cylinder.

INTERNAL GRINDER

GREENFIELD No. 12, HYDRAULIC FEED, Motor Drive; Cap. swings 15" Grinds automatically ¾" to 5" dia.; 4" Deep; **New in 1928.**

MILLING MACHINES

**No. 1 Cleveland, Motor Drive—$1,750.00.
Coolant Pump, Motor $95.00 Extra.
cap. 18" longit. feed
16" Vertical travel
8½" cross travel
table working surface 8"x32"**

No. 12 Pratt & Whitney Lincoln Production Miller.
No. 2 Pratt & Whitney Lincoln Production Mill.
1—3-H LeBlond Plain Miller, au. motor drive. Power feed all direction.
No. 1½ Sanford Miller.

THREADING MACHINES

14—Chicago Automatic Threading Machine
2—Waterbury Farrell Automatic Thread Rolling machines, ½" cap. with Hopper Feeds.
3—Waterbury Farrell Thread Rolling Machines with Hand Feed, ½" cap.
2—Waterbury Farrell #30 Rolling Thread Machines. Late type; like new.
6—Baker Presses set up for multiple threading.
2—Waterbury Farrell No. 158 Transfer Press or Eyeletting Machine.
2—Waterbury Farrell Trimmers.
2—No. 2 Liberty Back Flywheel Punch Press.
3—No. 82 Niagara Foot Presses.

LATHES

1—Prentiss 24"x14', 8 speed Gear Head, single pulley Drive with Taper Attachment, Chuck, etc.
12"x5' Crawford plain change lathe.
12"x5' Fay and Scott plain change lathe.
42"x25' PUTNAM triple geared, 17'6" centers; Plain change gear, screw cutting.
36"x18' PRENTICE Lathe 9' Centers—Pl. chge. screw cutting, chuck and standard equipment.
22"x16' REED light Pattern, Pl. Change gear; 11" Centers, $750.
19x8 LEBLOND Production Turning Lathe
1—16"x8' American C.G. Lathe—au. M.D.
11"x4½' DAVIS pl. change screw cutting engine lathe; complete; $225.
10"x4' LOGAN (NEW) Lathes, Ball Bearing Spindle; ½" Collet capacity; arranged for motor drive; power cross feed; $225, f.o.b. factory; priority certificate required; shipment from stock.
7"x36" PRECISION BENCH LATHES — Hardinge, Sloan & Chase and others.
8"x108" FITCHBURG LO-SWING LATHE; SPD.
18"x12' HAMILTON pl. Change, Cone dr. chuck
11"x4' PRATT & WHITNEY TOOLMAKERS LATHE, Taper att.
16"x6' SOUTH BEND pl. Chge., Screw Cutting Engine Lathes (2).

**COLD HEADERS
#22 Waterbury Farrell Cold Headers
Dble stroke Solid Die also #11.**

RADIAL DRILLS

DRESES 3' American Plain Radial, Motorized; REBUILT—READY TO GO.
DRESES 4' American Plain Radial, cone dr.

**DIE CASTING MACHINES
3—MADISON-KIPP late model, 10"x12", 12"x14", 12"x16".**

GEAR CUTTERS

No. 2 WHITON SPUR GEAR CUTTER, Auto.
36" Gould & Eberhart, "Victoria Model" perfect Cond.
48" Gould & ERERHART, Motor Driven; Complete; Perfect Cond.
No. 36B Gould & Eberhart Spur and Bevel Gear Cutter, Motor Dr.

ELECTRIC FURNACE

Ajax Northrop laboratory, electric induction type furnace, 220440 volts, 25 cycles, cap. 20 lbs. crucibles, Vacuum type melting unit was included, complete with G.E. transformer 440-44 volts.

HAMMOND 10 H.P. BUFFERS—8 months old. Motors in base, 3-60-220/440.

NEW LINES—WE SELL DRIES & KRUMP "CHICAGO" PRESS BRAKES AND BENDING BRAKES; STREINE POWER SQUARING SHEARS; BUFFALO DRILLS AND IRON WORKERS; CLEVELAND MILLING MACHINES; INDEX UNIVERSAL VERTICAL MILLERS; TROYKE ROTARY TABLES; L-W LATHE CHUCKS; INDEX HEADS; MAGNETIC CHUCKS AND HACK SAWS; VISES; OSWEGO MACHINISTS BENCH VISES; B-LINE MOTORS; VALLEY ELECTRIC GRINDERS; INQUIRIES INVITED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

. . IN STOCK

AUTOMATICS
No. 515 National Acme, four spindle
No. 52 National Acme, four spindle
1¼" Cleveland Model A, single spindle

BROACHES
No. XB10 Oilgear Hydraulic Twin spindle
15 Ton Hercules Vertical

DRILLS
4' Prentice Radial
No. 1½ Foote Burt, 2 spindle
No. 15½ Foote Burt Fixed Center
No. 37 Natco Multiple Spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrell, 2 spindle, m.d.

GEAR CUTTERS
No. 5 Cincinnati Automtic Gear Cutter
No. 3 Brown & Sharpe Automatic
No. 36 BM Gould & Eberhardt Rougher, three spindle
No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS
6x18 Landis Cylindrical
10"x20" Landis Cylindrical hydraulic
12"x42" Landis Cylindrical
No. 55 Heald Cylinder
No 60 Heald Cylinder
No. 24—53" Gardner Disc

LATHES
17"x8' Sidney, c.d.
18"x6' Lodge & Shipley, c.d.
24"x14' Reed Prentice, q.h.
24"x16" Whitcomb Blaisdel, c.d.
26"x14' Niles-Bement-Pond, c.d.
17"x8' Wickes Production, c.d.
3½"x60' Fitchburg Lo-Swing, q.h.
Duomatic No. 3 Lodge & Shipley

TURRET LATHES
No. 3A Warner & Swasey, q.h.
No. 6A Potter & Johnston, q.h.
3x36 Jones & Lamson, q.h.
No. 9 Bardons & Oliver, c.d.

MILLS
No. 1½ B S Milwaukee, s.p.d. double o.a.
No. 1 Milwaukee Manufacturing, s.p.d.
No. 5C Becker, Vertical
4" Bement Niles Horizontal Boring

MISCELLANEOUS
No. 3E Lees-Bradner Thread Miller, collet type
⅜"x18' Nilson Wire straightener
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 2 Davis Keysteater

PLANERS AND SHAPERS
36"x36"x12' Niles Double End Planer
32"x32"x10' New Haven Planer
18"Lodge & Davis Shaper, c.d.
20" Rockford Shaper, c.d.
20" Wolcott Shaper, c.d.
24" Cincinnati Shaper, c.d.

TAPPERS
½" Rickert Shafer Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

MOREY
DEPENDABLE USED MACHINES

G. & E. 48" Gear Cutter
WHITON No. 15 Auto. Gear Cutter
FELLOWS No. 6 Gear Shaper
INGLE 12" Gear Tooth Rounders
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-11"-18" Bevel Gear Generators
LEES BRADNER #5A Gear Generator
LANDIS 3½" Internal Hydraulic Race Grinder
LANDIS 16"x36" Plain Cyl. Grinder—M.D.
NORTON 14"x50" Plain Grinder —M.D.
HEALD No. 60 Internal Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
GARDNER No. 6 Dble. End BB Disc Grinder
P. & W. 6"x132" Thread Miller
AUTOMATIC MACHINE CO. 12x4' Threading Lathe
BRIDGEFORD 27"x10' Boring Lathe

NORTON 10x96 Plain Grinder —Arranged for motor drive, including motors

P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
BLISS No. 31 Power Press
ESPEN LUCAS No. 138 Cold Saw —Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Cutter
GRAY 30"x30"x8' Planer — 2 heads on cross rail—M.D.
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
KELLER E3 Auto. Profiler (Die Sinker)
GISHOLT Precision Balancing Machine

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your Specific Inquiries

MOREY MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

EASTERN OFFERS FROM STOCK

PLAIN CYLINDRICAL GRINDERS
10x18" No. 14 Brown & Sharpe, belt
10x24" Landis, m.d.
10x36" Norton, m.d.
10x36" Landis Integral Cam, m.d.
10x50" Norton, m.d.
10x52" Landis, m.d.
10x72" Norton, m.d.
12x36" Cincinnati, belt
12x36" Modern, belt
12x36" Modern, m.d.
12x42" Landis, belt
12x48" Modern, m.d.
16x120" Landis, m.d.
26x96" Landis, m.d.

UNIVERSAL CYLINDRICAL GRINDERS
No. 2 Universal Grinding Machine Co., belt
12x42" Modern, belt
12x48" Cincinnati Self-Contained, m.d., late type

VALVE SEAT GRINDER
Cincinnati Centerless Type Valve Seat Grinder, m.d.

CYLINDER GRINDERS
No. 50 Heald, hydraulic, m.d.
No. 55, 60, 65 Heald, mechanical feeds

EMERY GRINDERS
Leland & Faulconer No. 1 Wet
Mitchell-Bennett Buffer
Strand M7 Flexible Shaft Grinder
Rockford Wet, belt
Springfield Wet, m.d.
Diamond Emery, belt
No. 8 Hanson & Van Winkle Polishing
Hill-Curtis Polishing
Mitchell Engineering Type A1 Polishing, m.d.
5 H.P. Northern, m.d.
U. S. Electrical Tool Polishing, m.d.

INTERNAL
No. 10 Bryant, belt

SURFACE
Walker Single Stroke Surface, 10" magnetic chuck
No. 1 Fraser Lapper, belt

MANUFACTURING LATHES
3½x36" Lo Swing
3x80" Lo Swing
11"x4' Wells Speed
12"x5' Sebastian Geared Head Turning
14"x6' Champion Mfg.
15"x6' Automatic Threading
16"x6' Fulton
16"x6' Rockford
20"x8'American Turret
30" Streit Pulley Lathe
Niles-Bement-Pond Axle Lathe
42x96" No. 5 Niles-Bement-Pond Center Driving Car Wheel Lathe, new
Niles-Bement-Pond Quartering Machine, m.d., new

MILLING MACHINES
No. 2 Knight, s.p.d.
No. 5 Becker Vertical
18" Cincinnati Mfg., m.d.
4½x12" Pratt & Whitney Thread
6x14" Pratt & Whitney Thread
Pratt & Whitney Lincoln Type
36"x36"x14' Bement Slab, m.d., p.r.t.
40" Ohio Tilted Rotary, m.d.

PIPE MACHINES
1¼" Landis 2 spindle Pipe & Nipple, belt
2" Bignall & Keeler, belt
2" Bignall & Keeler, m.d.
2" Jarecki, m.d.
4" Eaton, Cole & Burnham, cone
4" Bignall & Keeler, belt
4" Merrell, belt
15" Cox, belt

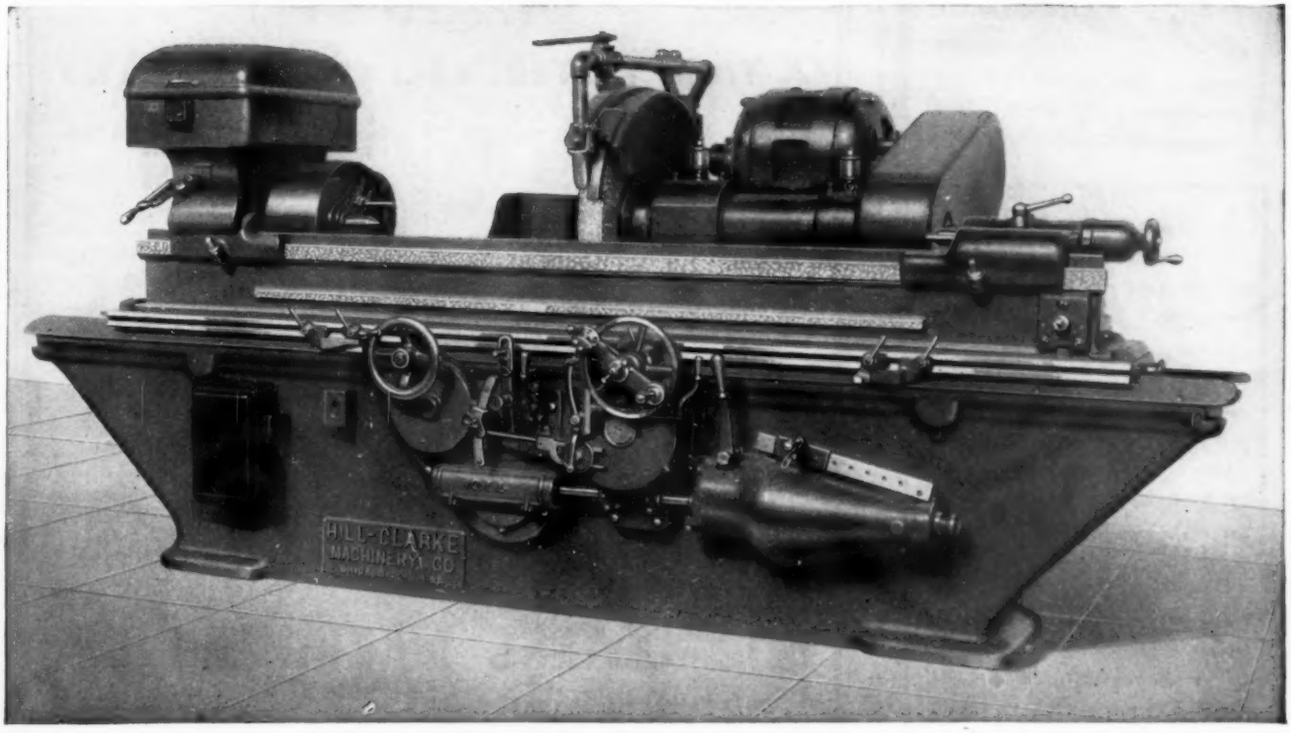
PLANERS
24"x24"x6' Gray, 1 head
26"x26"x8' Niles, 1 head
36"x36"x8' Ohio, 1 head

PRESSES
Waterbury-Farrel S.A. O.B.
No. 2 American Can Inc.
P2 Ferracute Stiles Type
42 Ferracute S.A. Drawing
No. 6 Waterbury-Farrel D.C.
30 ton Lourie Hydraulic type BX
851 Ferracute D.C.
Metalwood Hydro-Pneumatic B33
No. 268¼B Toledo D.C. Toggle Drawing, weight 175,000 lbs.
No. 496D Toledo D.C. Toggle Drawing, 95x50" bolster, 160,000 lbs.

Many other machines in stock.
Send us your inquiries

The **EASTERN MACHINERY CO.**
1004 TENNESSEE AVE.
CINCINNATI, OHIO

Yours for Super Grinding!



HILL-CLARKE MODERNIZED CYLINDRICAL GRINDERS

give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES			
10 x 36	14 x 36	14 x 72	16 x 72
10 x 50	14 x 50	16 x 50	18-30 x 96

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO

In stock

Every machine listed in this column is in our warehouse at press time.

RAILROAD SHOP TOOLS

48" PUTNAM Car Wheel Borer
52" BETTS Car Wheel Borer
42" PUTNAM Car Wheel Lathe
42" NILES Car Wheel Lathe
48" NILES Car Wheel Lathe
85" PUTNAM Driving Wheel Lathe with Quartering Attachment, M.D.
27" BRIDGEFORD Journal Truing
Set of Locomotive Cylinder Chucks
Slotting Attachment for Vertical Miller
No. 3 BEMENT 2 Spindle Gang Drill
Nos. 9 & 10 NBP Vertical Millers
30" x 30" x 10' NEWTON Slab Miller
7" Cap. NEWTON Cold Saw
60" NEWTON Portable Slotter
30" BAKER Draw Stroke Slotter, M.D.
16" SELLERS Slotter, M.D.
14" PUTNAM Slotter, M.D.
12" SELLERS Slotter, M.D.
No. 2 STOVER Pipe Bender

PUNCHES AND SHEARS

20" Throat H&J No. 00 3/4" x 3/8"
42" Throat L&A No. 2 1" x 1"
42" Throat H&J No. 2 1" x 7/8"
42" Throat H&J No. 4 1 3/4" x 1"
54" Throat H&J No. 5 1 3/4" x 1 1/8"
60" Throat L&A No. A 1 3/4" x 1"
24" Throat L&A Double End 3/4" x 3/4"
RT 40 SCHULTZ-NAUMAN Beam Shear
6" x 6" x 5/8" Angle Shear
L&A Multiple Punch 6" x 72"
NIAGARA Circle Shear 1/8" x 18"
Washer Press, SOUTHWARK No. 3

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 North Broadway, Albany, N. Y.
N. Y. Office: 149 Broadway

USED MACHINE TOOLS
OFFERED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS
1 spdl. Henry & Wright
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
2 spdl. Henry & Wright
4 spdl. Henry & Wright
4 spdl. Sigourney
4 spdl. Woodward & Rogers
6 spdl. Henry & Wright
2 spdl. Baker Cylinder Borer

GEAR CUTTERS
No. 60 BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS
(See page 199—special advertisement Hill-Clarke Cylindrical Grinders)
22"x96" Norton Plain, M.D., Roll Forming Attachment
No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating
No. 10 Lees-Bradner Spur Gear Grinder
No. 60 Heald Cylinder
1½" dia. New Yankee Drill Grinder

LATHES
3½"x53" Fitchburg Lo-Swing
No. 4 AC LeBlond Auto. Duplex Crankshaft

SLOTTERS
10" Newton

MISCELLANEOUS
60" Quickwork Rotary Shear
6" Saunders Pipe Machine
No. 4 Gaterman Tapper, 5/16" Cap.

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. CHICAGO

HIGH GRADE MACHINE TOOLS

LATHES
16" x 10' South Bend Gap Type Lathe. Standard Change.
42" x 14' Niles Lathe, Cone Drive.

GRINDERS
#60 Heald Internal, Belt Drive
#14—20" Besley Disc Grinder, Belt Drive.
16" x 72" Landis Self Contained Plain Grinder, M.D. Complete.
#5 Oliver Drill Grinding Machine, M.D.
#50 Heald Internal Cylinder Grinding Machine.

GEAR CUTTERS
#3—26" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.
#00 Pfauter Gear Hobbing Machine, M.D.
#1 Schuchardt & Schutte Gear Hobbing Machines.
#18H Gould & Eberhardt Gear Hobbing Machine.
#5-60" B & S Automatic Gear Cutting Machine.
Bilgram Automatic Gear Cutter.

BOLT & PIPE THREADERS
4" Williams Pipe Machine.

SHAPERS & PLANERS
16" Rockford Crank Shaper, Back Geared.
32" x 32" x 18' Gray Planer, 2 Heads.
60" x 48" x 18' Betts Planer, side Head and rail head.

MILLERS
48" x 35" x 8' Niles Bement Pond Planer Type Slab Miller, Adjustable rail, Two vertical Heads, Horiz. rail, M.D.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

FOR SALE

No. 8 Ajax BULLDOZER, M. D.

PIPE THREADING MACHINES
1—Landis, 1" to 4"
1—R-B Williams, high production
1—4-B Williams, with motor
1—2" Bignall & Keller

SHEARS
#3 Ryerson Lennox Bevel, 1" cap.
#7 United Alligator, cap. 6½" sq.

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave., Chicago, Illinois
37 years' experience
"*Anything* containing IRON or STEEL"

OTT MACHINERY SPECIALS

AUTOMATICS, Cleveland, 1¼ & 2, Model A
AUTOMATICS, Cleveland, ⅝" 4 spdle. Model M
AUTOMATICS, Cleveland, ⅞ & 1⅛" Model B, M. D.
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, Landis 10x36" Hydraulic, M.D.
MILLING MACHINE, Lees-Bradner #3 Thread
MILLING MACHINES, Craftsman #1, 2 & 3
PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #2 to 6 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

500# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Ely Vert. Miller & Shaper, M.D.
Bolt Cutters 1"x1¼"-2"-3"-4" Acme.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
Turret Lathe, #2 W&S Fct. Head.
No. 2 Baker Keyseater, 2"x20".
Pipe machines 2"—18".

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

50 lb. Beaudry Hammer
40 lb. William Hammer
16"x32 Bridgeport Automatic Threading Lathe
10"x6" Higley Power Saw
24" Becker Brainard Automatic Gear Cutter for spur and bevel
Fisher Profile Grinder

INDUSTRIAL MACHINERY COMPANY
357 Dublin, Columbus, Ohio Adams 3534

SEARCHLIGHT SECTION

AUTOMATICS

1" **Cleveland** Model J Double end.
No. 454 **Gridley.**
4½" **Gridley** Model H.
No. 33 **New Britain.**
No. 16 **Gisholt.**
1"x18" **Pratt & Whitney** automatic lathes.
5" **Bullard** 4 spindle "Vert-au-matic".
6" **Baird** Model B 6 spindle.
6"x6¾" **Goss & Deleeuw.**
14"x19" **Fay.**
Edlund Model SP-107 automatic.

GEARS

No. 18H **Gould & Eberhardt** universal gear hobber.
8"x10" No. 1 **Lees Bradner** production hobber.
14"x8" No. 5A **Lees Bradner** universal hobbers.
26"x8" No. 3 **Brown & Sharpe** auto spur.
36"x6" **Gould & Eberhardt** spur gear cutter.
48"x10" No. 4 **Brown & Sharpe** automatic spur.
Gleason circular finishing cutters, without blades.
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machines.
Lipe gear tooth chamfering machine, double spindle.
No. 3 **Barber Colman** gear hobber.
18" **Gleason** bevel gear generator.
Nos. 60, 61 & 62 **Fellows.**
Gleason gear roughers.
Gleason gear testers.
Gleason gear lappers.

LATHES, ENGINE, TURRET & PRODUCTION

11" 3' **South Bend** Model 8Y.
22"x10' **American** with hex turret.
No. 2 Southworth.
2' spindle **Jones & Lamson.**
No. 2 **Warner & Swasey.**
No. 4 **Warner & Swasey.**
No. 3 **Wood Tilted Turret.**
3"x36" (14½" swing) **Jones & Lamson,** cross feeding headstock.
22" **Steinle.**
36" **Libby.**
28" **Steinle.**

BROACHES

No. 1 **La Pointe,** screw type.
No. 2 **Standard** screw type broaching press.
No. 3 **LaPointe of Hudson,** screw type.
No. 3 **J. N. LaPointe** double screw type.
No. 3 **American** high speed, rack type.
No. 4 **LaPointe.**

GRINDERS, CYLINDRICAL, PLAIN AND UNIVERSAL

10"x24" **Norton.**
10"x24" **Landis.**
12"x30" **Fitchburg.**
10"x36" **Norton.**
10"x36" **Cincinnati.**
10"x50" **Norton.**
12"x36" **Landis** self contained.
18"x72" **Landis Walker** 8" dia. chuck surface.
No. 5 **Bridgeport** tool.
Gisholt tool grinder for lathe, planer or shaper tools.
24" **Ingersoll** tub type face milling cutter grinder.
2¼" **Wilmarth & Morman** drill grinder, belt drive.
18" **No. 2 Gardner** double end disc grinder.
18" **Gardner** semi-automatic disc grinder.
24" **No. 4 Gardner** double end disc grinder.
24" **No. 84 Gardner,** opposed discs, V-belt motor drive.
53" **No. 24 Gardner** horizontal disc grinder with motor.
5"x7" **Pratt & Whitney** worm or thread grinder cam feed type.
Hutto honing machine, type MD. Capacity holes 1" to 6" (Diameter, up to 12¼" deep.)
No. 15A Bryant internal grinder (hole and face grinder).
No. 6 Bryant internal grinder.
No. 12 Greenfield internal.
No. 50 Heald hydraulic cylinder grinder.
No. 60 Heald cylinder grinder.
Type 15 **Norton** vertical lapping machine.
No. 575 Hawes continuous rod and tube polisher, centerless feed.
10"x50" **Norton** cam shaft grinder.
17"x36"-48" **Norton,** Type B, Model 84 hydraulic crankpin grinders.
16"x4" **Norton** style D snagging grinder.
30"x4" **No. 41 Ransom** snagging grinder, double end, motor on spindle.

LATHES, PRODUCTION

1"x18" **Pratt & Whitney** automatic.
9"x14" **Porter Cable.**
13"x18" **Adams "Short Cut".**
13"x6' Automatic threading lathes, geared head.
20"x8' **Wickes** 12-speed geared head rapid production.
Three **Gisholt** Simplimatics.
Melling 4-cylinder camshaft lathe.
Melling 6-cylinder crankshaft lathe.
13"x20" **Seneca Falls** Model B.
14"x32" **Acme Model** No. 2.
28"x15' **Bridgeport** axle lathe.

MILLERS, PLAIN, VERTICAL AND MISCELLANEOUS

12" **Cincinnati** plain Mfg.
No. 12 **Brown & Sharpe,** plain Mfg.
Taft Pierce type A internal thread mill.
Model AB **Becker** Vertical, 10¾"x32¾" table.
36" **Niles** vertical car wheel boring machine.
No. 6 **Whitney** hand.
Nos. 1 & 1A **Davis & Thompson** drum type continuous.
Nos. 10 & 45 **Bilton** Productomatic.
2½" **Lucas.**
4⅞" **Berman & Smith.**
5" **Barrett** cylinder borer.

SHEARS, SHEET METAL AND WIRE MACHINERY

No. 1 **Hilks & Jones** alligator shear, capacity 1¼" round, 4"x1" flat, blades 12" long. 10" blades.
Lewis alligator shear, 10" blades.
Newbold guillotine shear, 2" capy.
No. 15 **Stanley** uni-shear with motor, 14-ga. capy.
18" **Pels** all steel beam shear.
4'x¼" Series 40-4 **Cincinnati** press brake.
12'x10 ga. Geo. A. Ohl press brake.
Nos. 1 and 2M **Pettingell** bumping hammers.
No. 3 RH **Magee** wiring machine.
¾"x3' **Shuster** wire straightener and cutter.
⅝"x5' **Shuster** wire straightener and cutter.
Sleeper & Hartley coiling machines.
Sleeper & Hartley heavy coiling machine.
No. 225A **Bliss** slitter.
Bay City bending rolls.
No. 352 **Toledo** bending rolls.
"Thread Rolling" horizontal thread roller.
Mail Us Your List of Surplus Tools.

MILES MACHINERY CO. - - - Saginaw, Mich.

BRADLEY HAS THE BUYS
IN ALL THESE TYPES OF MACHINE TOOLS

DRILLS

2 spindle Leland Gifford
4 spindle Woodward & Rogers
6 Spindle Allen
Baush Multiple
4—14" Drills
20" Barnes
21" Mechanics Drill
22" Sibley
24" Hoeffer
25" Snyder
28" Weigle

GRINDERS

2—#20 Bryant Internal
Norton double end
#4 Gardner Disc

LATHES

20x10' Perkins LCG
Fitchburg LoSwing
LeBlond Double End
Seneca Falls Lathe
16x6' Monarch Gap

MILLS

Garvin #2 Hand Mill
Porter #500 Vertical
#1 Bristol Hand Mill
Taft Peirce Thread Mill
#3 Burke Bench Mill
#6 Whitney Hand

PLANERS

26x26x8' Ames
Yager Wood Planer

SAWS

2—30" Band Saws
5' Crescent swing saw
10" Circular saw
Toledo Hack saws (new)

SHAPERS

New 8" Shape Rite Shapers

MISCELLANEOUS

#3 Niagara hand shear
#5 Foster Turret lathe
10" Dill slotter
Hancock flame cutting machine
National Acme stud threader
3 ton portable crane
2 ton electric hoist
Waterbury Farrell DSSD Cold header with attachments
Waterbury Farrell bolt trimmer
Williams pipe cutting machine
#1 LaPointe Broach
2—8" Gleason gear generators
#00 Raymond Pulverizer

PRESSES

PG5 Ferrecute
#4 Bliss Punch
#94 Bliss Consolidated Punch
New Famco Arbor Presses
#101 Niagara Punch Press

BRADLEY MACHINERY COMPANY

211 Jos Campau — **Detroit, Mich.**

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Prentice Pl. Cone Drive Radial Drill
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Gisholt Univ. Tool Grinder
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY

1392 West 3d St., Cleveland, Ohio — 2832 E. Grand Blvd., Detroit, Mich.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DeWITT TOOL COMPANY

173 Grand St. — **New York City**

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40", M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Univ., No. 5 B & S, 20" x 72".
GRINDER, 18' x 30' x 96' Norton Cyl., M.D.
LATHE, Driving Wheel, 78" Bement, Dbl. End.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'
SLOTTER 15" Dill Table Dia. 34".

LANG MACHINERY COMPANY

28th St. & A.V.R.R. — Pittsburgh, Pa.

No. 2 P & W Shaving Machine
No. 6 Fellows Gear Shaper
No. 1 Bilton Gear Milling Machine
No. 3 Crescent Saw Table

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CYLINDRICAL GRINDER

12" x 96" LANDIS Plain Cylindrical Grinder Belt Drive machine, with countershaft; also headstock and tailstock.
Automatic Feed machine, including wheel-feed adjusting device.

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Modern Grinders 16" x 60" blocks up to 22" M. D.
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LATHES

21" x 10' LeBlond G. H. crank shaft lathe Q. C.
1—Lodge and Shipley 18" x 8' M. D.
Monarch 16" x 8' M. D. Q. C.
1—Davis 16" x 8' M. D. Q. C.
1—Prentice 20" x 10'
Lathe and Morse 24" x 12'

AUTOMATICS

1—National Acme 55 M. D. #73
2—Clevelands ⅞" 4 spindle M. D.
2—New Britains 1" x 5"

TURRET LATHES

1—2¼ x 24 J & L
1—2 x 24 J & L
1—Woods 1⅝" B. G.
1—Woods 1"
Acme 1½"
Millholland 1⅝"
2—Warner-Swasey
1—Gisholt 5¾"

DRILLS

1—6' Prentice M. D.
1—4' Bigford
1—4' Niles M. D.
1—36" Niles Vertical
1—Foot Burt heavy duty
4—2 and single spindle Allens

SHAPERS

1—24" G. & E. M. D.
1—16" Becker M. D. and B. G.
1—16" Ohio
1—14" Chase
1—12" G. & E.

MISCELLANEOUS

1—Punch heavy duty 36" throat M. D.
Binsee Horizontal Boring Mill 2"
1,000 lb. Chambersburg steam or air hammer
#3 Les Bradner thread Miller
1—26" Brown and Sharpe Gear Cutter
1—36" Fellows
1—Pratt and Whitney Thread Grinder
10", 12", and 14" Newton Slotters
Bedford 25 ton crane 50' span

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GRINDERS

#1 Gardner Hydraulic face, motor drive, table 10"x30".
12"x36" Pratt & Whitney Surface.
2—#60 Heald Internal cylinder.

LATHES

26"-50"x18' McCabe 2-spindle, belt drive.
24"-48"x12' McCabe 2-spindle, belt drive.
26"x10' Crawford, motorized, quick change.
21"x8' LeBlond 3-step cone DBG quick change mtzd.
20"x14' Springfield, geared head, single pulley drive, quick change.

MILLERS

(5) Hand Milling Machine, mtzd.
#3 Lees Bradner Thread Miller, motorized.
#8 Becker Duplex, belt, table 11"x40".
#104 Newton Slab, planer type, table 14"x54".

SHAPERS

16" Barker, back geared, cone drive.
16" Barker, single geared, cone drive.
16" Flather, single geared, cone drive.

TURRET LATHES

28" Bogart belt drive 4" hollow spindle.
24" Gisholt, motor drive, 2½" hollow spindle.
15" Gisholt, belt dr. 1¼" H.S. 6 tool holders.
25"x10' LeBlond, motorized. Quick change.
21"x8' LeBlond turret on carriage QC.
3"x36" Jones & Lamson, geared head, bar equipment.
Fitchburg LoSwing, 3½"x60".

MISCELLANEOUS

#6 Cochrane Bly 24" Cold Saw.
2½ to 8" Williams Pipe Machine, motor drive.
Henderson geared Forming Press, 40" between housings with dies.
#6A Hunter high speed Saw, motor drive, 14" blade.
200 ton Caldwell Wheel Press, 36" between bars.
½"-2" Landis Pipe Machine, belt drive.
4' Bending Roll, drop end, 4" rolls, belt drive
10" Burton Slotter, 24" dia. table, belt drive.

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24" Bement, belt drive, arch jaw, cap. ⅝x⅝.
½" cap. Ryerson Rotary Bevel Shear, belt drive.

THE O'BRIEN MACHINERY CO.

OFFICE: 113 NORTH THIRD STREET, PHILADELPHIA, PA.

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GEAR CUTTERS—84" & 60" Gould & Eberhardt, Spur (2); 11" & 6" Gleason Bevel Gear Generators (4); 36" G & E Spur and Bevel. 48" & 36" Cinci spur (2);
KEYSEATERS—#3 Baker, 26" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M.
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PLANERS—72" x 72" x 18' Cincinnati, 2 heads. 72" x 60" x 14' Cincinnati, 3 hds. D.C. reversing M.D. 60"x48"x14' Bertram Openside, 3 hds., DC Reversing M.D.; 26" x 8' Gray, 1 head.

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GLEASON 11" Bevel Gear
BROWN & SHARPE 26", 36" Gear Cutters
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MILLING MACHINES

2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sunstrand Rigid Mill M.D.

TURRET LATHES

Goss & De Leeuw Chucking, 6"x6½"

DRILLS

3' Morris Radial En. Hd. M.D.
No. B16 Natco M.D. (2)
4 Spindle Taylor & Fenny M.D.

GEAR MACHINERY

6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

GRINDERS

No. 20 Heald Surface M.D.

MISCELLANEOUS

8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
No. 4 Hilles & Jones Double End Punch and Shear
No. 303 Bliss St. Side Gd. M.D.
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PLANERS:

Betts 60x60x24, 2 heads on rail
Sellers 72x72x20, 4 heads

MILLING MACHINES:

#13 Garvin Plain
#3 Hendey Universal
#5B Becker Vertical Milling Machine

TURRET LATHES:

#2 Warner & Swasey
3x36 Jones & Lamson, geared head
2—#3A Warner & Swasey
2 x 24 Jones & Lamson, geared head
Libby 7½" hollow spindle chucking lathe

GRINDERS:

2—#3 Modern Cylindrical Grinders
#12 Brown & Sharpe Tool & Cutter Grinder
#2 Walker Tool & Cutter Grinder
#52 Hydraulic Internal Grinder
14" Pratt & Whitney Ball Bearing Vertical Grinder
#65 Heald Internal

SHAPERS:

24" Gould & Eberhardt
24" Cincinnati
16" Gould & Eberhardt
16" Steptoe

LATHES:

32"x16' Putnam
28x12 Schumacher & Boyse
16x6 Hendey
16x6 Flather

PRESSES:

Bliss #4
Bliss #0

DRILLS:

36" Putnam
18" American Tool Works
Combination Drilling, Milling & Boring Machine
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1—Brinnel Tester
1—No. 2 Baxendale Punch Press, M.D.
1—No. 62 Bliss Punch Press, M.D.
1—No. 1A Wm. Sellers Tool Grinder
1—No. 3 Holmes Tilted Tapper
1—Universal Gear Tester
1—4 Spindle Barr Drill Press

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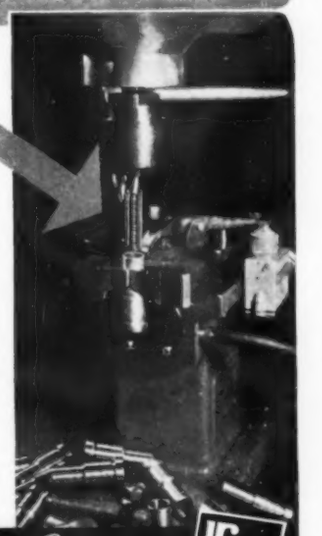

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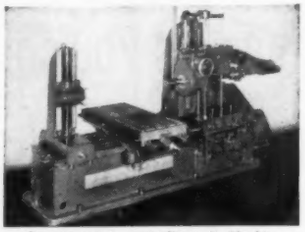

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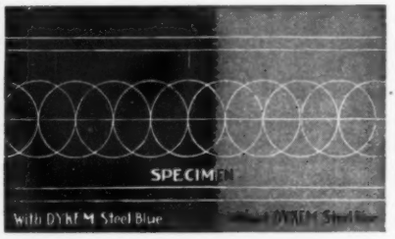

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National Twist Drill & Tool Co., Detroit
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Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

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BLADES, Cutter, Milling, Boring & Reaming (See BITS, Tool)

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Starrett Co., L. S., Athol, Mass.
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National Auto. Tool Co., Richmond, Ind.
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Universal Boring Mach. Co., Hudson, Mass.

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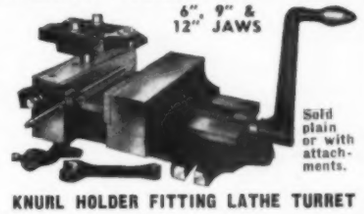

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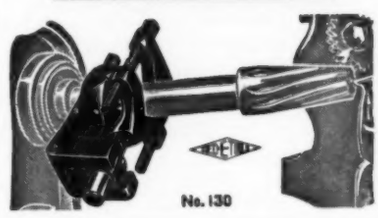

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

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Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

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CEMENT, Refractory
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Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
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Sturdimatic Tool Co., Detroit
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Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

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McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
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CHAINS, Transmission
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Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

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Revere Copper & Brass Inc., N. Y. C.

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Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
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Gorton Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

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CHUCKS, Collet (See Collets)

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Gisholt Machine Co., Madison, Wis.
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CLEANING EQUIPMENT (See METAL-CLEANING EQUIPMENT)

CLOTH, Abrasive (See PAPER & CLOTH, Abrasive)

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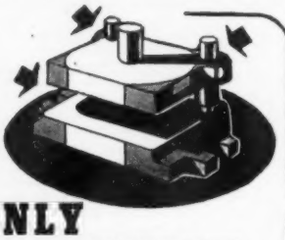

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Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
Hamilton Tool Co., Hamilton, O.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn.
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See **WHEELS, Grinding & Polishing**)

DISKS, Circular Cuttting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See **CALIPERS & COMPASSES**)

DOGS, Lathe & Milling-Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
LoBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
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Desmond-Stephan Mfg. Co., Urbana, O.
Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Metal Carbides Corp., Youngstown, O.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark (Radius)
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See **STEEL, Tool**)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLS, Bench
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.

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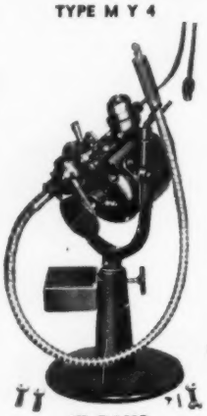

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Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

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Firth-Sterling Steel Co., McKeesport, Pa.
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National Twist Drill & Tool Co., Detroit
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Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

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Baker Bros., Inc., Toledo, O.
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Barnes Co., W. F. & John, Rockford, Ill.
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National Auto. Tool Co., Richmond, Ind.
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Haynes Stellite Co., N. Y. C.
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National Twist Drill & Tool Co., Detroit
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See **DRILLS, Twist & Flat**)

DRILLS, Hand (See **TOOLS, Hand**)

DRILLS, Horizontal
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Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
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Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Machine and Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.
Ryerson & Son, Jos. T., Chicago
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Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DRILLS, Multi-Spindle or Gang
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Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Grant Mfg. & Mach. Co., Bridgeport, Conn.
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Hamilton Tool Co., Hamilton, O.
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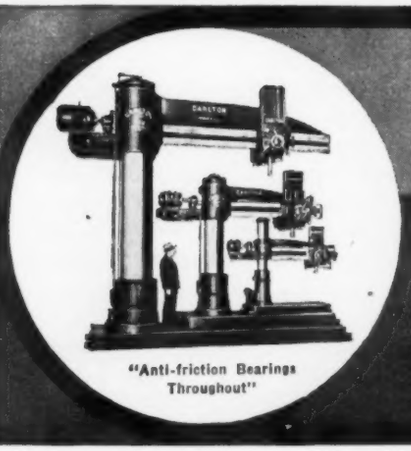
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Portable Electric (See **TOOLS, Portable Electric**)

DRILLS, Portable Pneumatic (See **TOOLS, Portable Pneumatic**)

DRILLS, Radial
American Tool Works Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Carlton Machine Tool Co., Cincinnati
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Mach. Tool Co. Cincinnati
Cleveland Punch & Shear Works, Inc., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Morris Machine Tool Co., Cincinnati



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Morse Tool Co., Detroit
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Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

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DRIVES, Worm
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Michigan Tool Co., Detroit
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ENAMELS (See **PAINTS, VARNISHES, etc.**)

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Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland

FANS, Man-Cooler (See **BLOWERS**)

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Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

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Littell, F. S. Mach. Co., Chicago
Producto Machine Co., Bridgeport, Conn.
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Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

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Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

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Lamson & Sessions Co., Cleveland
Watson-Stillman Co., Roselle, N. J.
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American Steel & Wire Co., Chicago
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Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N.J.

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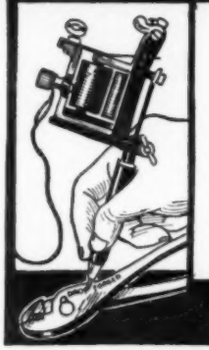

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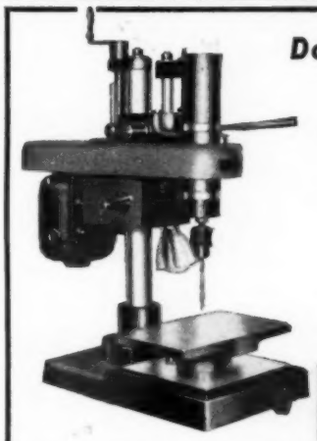

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Table Travel—15"
Cross Feed—9"
Vertical Feed—7"
Will grind cutters on centers—6¼"
Will grind cutters on holder—14" dia
Max. Cutter Shank Capacity of Holder—No. 12 B&S
Speed of Motor for cylindrical and internal work spindle—90 R.P.M.
Speed internal grinding spindle 13,000 R.P.M.
Capacity chuck—3¾"
Capacity vice jaws—2¼"
Motor—½ H.P. 3600 or 3000 R.P.M.
Floor space—62"x39"

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Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

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General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., Chicago
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

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American Gas Furn. Co., Elizabeth, N. J.
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, Ohio
Hones, Inc., Chas. A. Baldwin, N. Y.
Lindberg Engineering Co., Chicago
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Ames Co., B. C., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Specht Engineering Co., Brooklyn, N. Y.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

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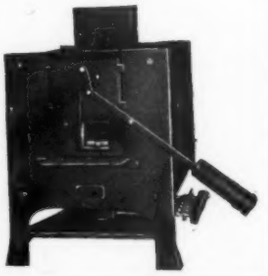

WRITE FOR DETAILS

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GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See ENAMELING & GALVANIZING MACHINES)

GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark, N. J.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland

GEARS, Master
Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GEARS, Non-Metallic
Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland
Taylor Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GRAINS, Abrasive
Bay State Abrasive Prod. Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O.

GRINDERS, Abrasive-Belt
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Mattison Machine Works, Rockford, Ill.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Bench & Pedestal
Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Machinery & Engrg. Co., Chicago
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Queen City Machine Tool Co., Cincinnati
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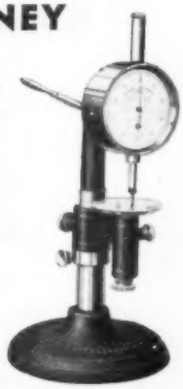

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Built in Many Sizes

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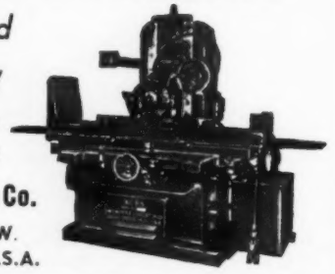

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Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J
Walls Sales Corp., N. Y. C.

GRINDERS, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Excello Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Wass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Walls Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Tool & Mach. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See ATTACHMENTS, Lathe)

GRINDERS, Portable Electric (See also TOOLS, Portable Electric)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Foote-Burt Co., Cleveland
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.

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Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Portman Mach. Tool Co., Mt. Vernon, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

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Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cell-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See **CONTRACT WORK**)

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneu. Tool Co., Cleveland

HAMMERS, Power
General Machinery Corp., Hamilton, O.
Sellers & Co., Wm., Philadelphia

HAMMERS, Softfaced
Greene, Tweed & Co., N. Y. C.
Johnson Tool Co., Inc., E. Providence, R. I.

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.

HANDLES, File
Disston & Sons, Inc., Henry., Philadelphia
Nicholson File Co., Providence, R. I.
Parker-Kalon Corp., N. Y. C.

HANGERS, Shaft
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
SKF Industries, Inc., Philadelphia

HARDENING MACHINES, Flame
Air Reduction, N. Y. C.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

HEADERS, Rivet
Ajax Mfg. Co., Cleveland
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.

HEADS, Boring
Bullard Co., Bridgeport, Conn.
Carboloy Co., Inc., Detroit
Criterion Mach. Wks., Beverly Hills, Cal.
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Calif.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co. Inc., Springfield, Vt.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

HEADS, Dividing
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Hartford Special Machry. Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
L-W Chuck Co., Toledo, O.
Scherr Co., Geo., N. Y. C.

HEADS, Drilling
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit
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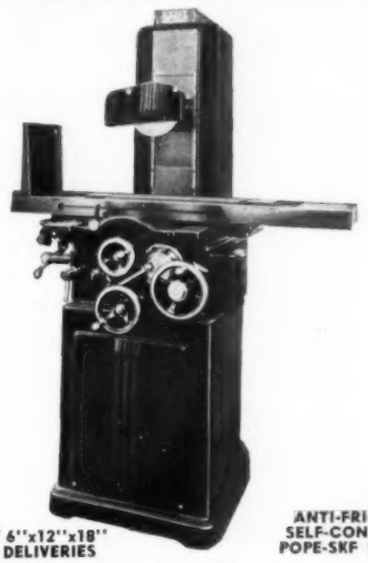

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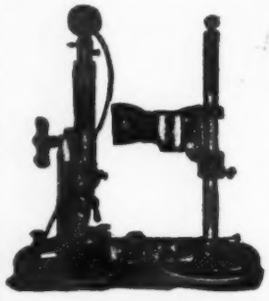

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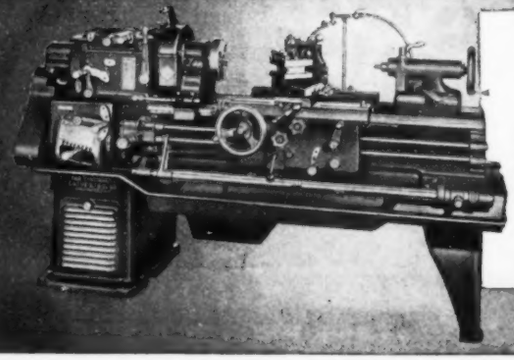

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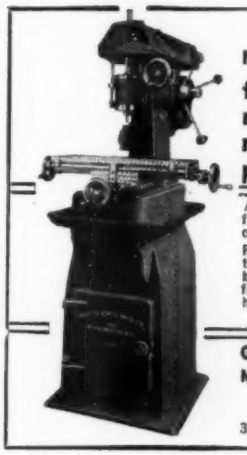

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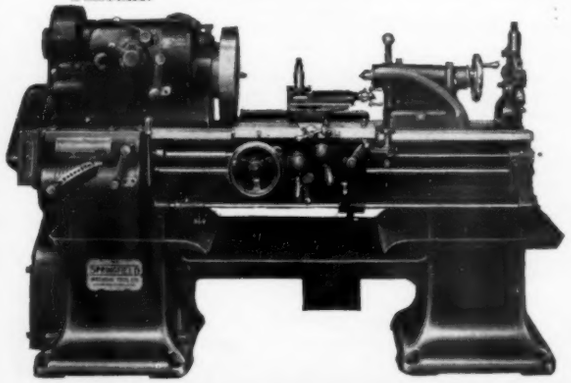

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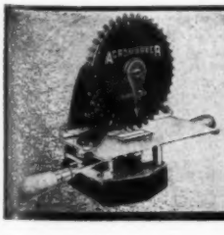

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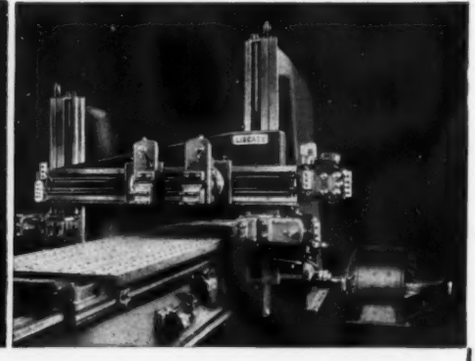

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Sellers & Co., Wm., Philadelphia

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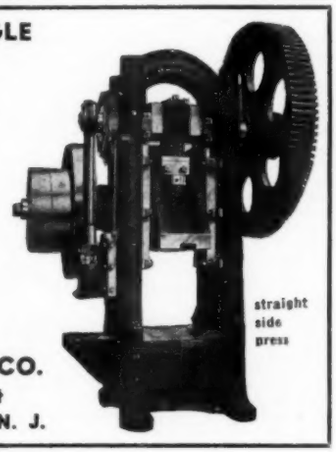

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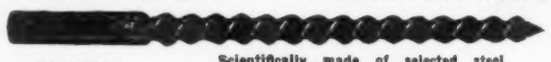

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Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schultz & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

RECORDERS, Speed (See INDICATORS, Speed)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Stahl Gear & Machine Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

REELS, Strip-Stock & Wire
Littell, F. J. Mach. Co., Chicago
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

WHERE-TO-BUY DIRECTORY

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Lamson & Sessions Co., Cleveland

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Ajax Mfg. Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. B., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

RULES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Porter-Cable Mach. Co., Syracuse, N. Y.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADES, Circular Metal-Cutting
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADES, Hack & Band (See **BLADES, Hack & Band-Saw**)

SAWS, Band, Metal-Cutting (Machines)
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Capewell Mfg. Co., Hartford, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Earle Gear & Machine Co., Philadelphia
Motch & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach. Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
Lamson & Sessions Co., Cleveland
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs., Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEALS, Oil
Gits Bros. Mfg. Co., Chicago

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland
Sparkler Mfg. Co., Mundelein, Ill.

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

SETTERS, Nut (See **TOOLS, Portable**)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.

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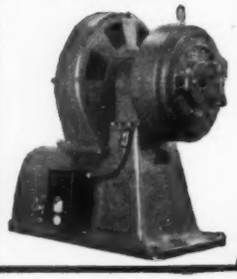

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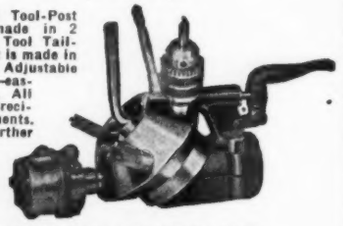

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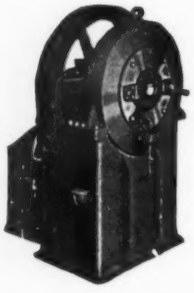

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WHERE-TO-BUY DIRECTORY

Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

SHEET-METAL WORKING MACHINERY (See **BRAKES, Bending Press; DIES, Sheet-Metal; FORMING Machines; NIBBLERS; PRESSES; REELS, Strip-stock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal**)

SHELL-MAKING Machinery
Bullard Co., Bridgeport, Conn.
Colman & Sons, Inc., Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIMS, Etc.
Laminated Shim Co., Glenbrook, Conn.

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See **TRUCKS, Hand**)

SLEEVES & SOCKETS, Drill
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago

SPROCKETS (See **GEARS, Cut**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

STEEL-MILL PRODUCTS
Allegheny-Ludlum Steel Corp., Pittsburgh (Steel and stainless steel sheets, plates, tubes, wire and strip)
American Steel & Wire Co., Cleveland (Cold-finished bars, wire and wire products)
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

STRAIGHTEDGES (See **DIE-MAKERS' SUPPLIES**)

WHERE-TO-BUY DIRECTORY

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

SUB-PRESSES & DIES (See Dies, Subpress)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

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SURFACE PLATES (See PLATES, Surface)

SWAGING MACHINES
Etna Machine Co., Toledo
Hardinge Brothers, Inc., Elmira, N. Y.
Torrington Co., Torrington, Conn.

SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
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Allis-Chalmers Mfg. Co., Milwaukee
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Clark Controller Co., Cleveland
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Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Adam Electric Co., Frank, St. Louis
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Clark Controller Co., Cleveland
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National Acme Co., Cleveland
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Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See INDICATORS, Speed)

TANKS & CYLINDERS, Air
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National Tube Co., Pittsburgh
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Snyder Tool & Engrg. Co., Detroit

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Warner & Swasey Co., Cleveland

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V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
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Strong, Carlisle & Hammond Co., Cleveland

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Genesee Tool Co., Detroit
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Heald Machine Co., Worcester, Mass.
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vaseoloy-Ramet Corp., N. Chicago, Ill
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

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Disston and Sons, Inc., Henry, Tacony, Philadelphia
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Sheldon Machine Co., Chicago

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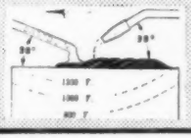

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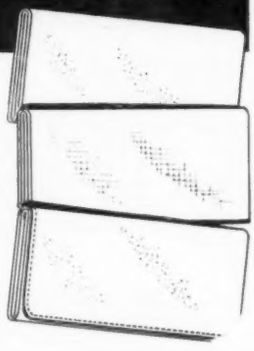

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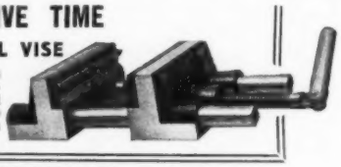

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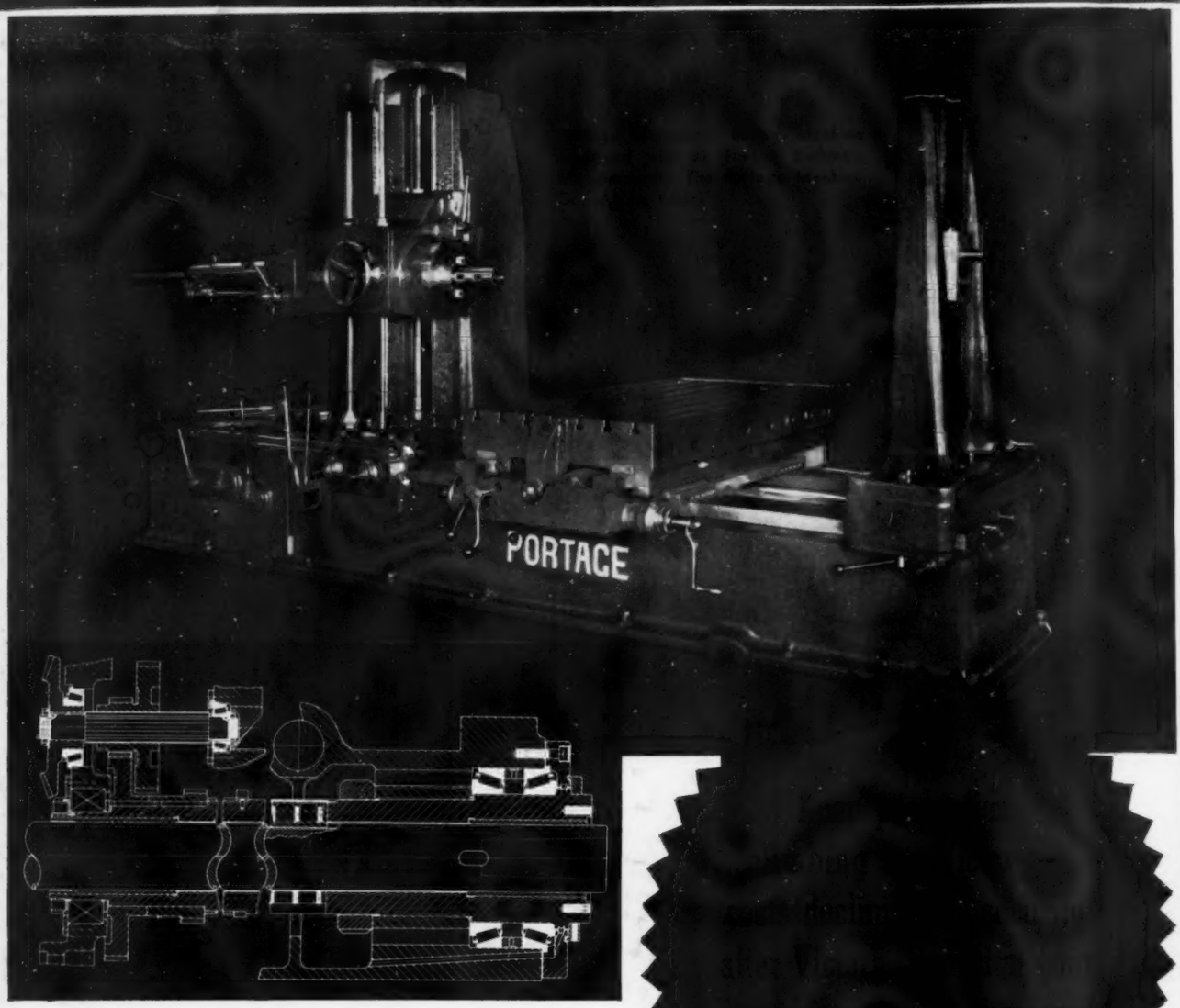

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